

**FEDERAL AVIATION ADMINISTRATION  
WESTERN SERVICE AREA  
LOS ANGELES, CALIFORNIA**

**SPECIFICATION FOR THE REMOTE TRANSMITTER RECEIVER FACILITY  
AIRPORT  
EARNEST A. LOVE FIELD, ( PRESCOTT REGIONAL AIRPORT)  
PRESCOTT, ARIZONA.**

**April 20, 2011**

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## **DIVISION 1 - GENERAL REQUIREMENTS**

### **SECTION 1-1 SUMMARY OF WORK**

#### **1-1.1 General Summary of Work:**

This specification, together with the referenced specifications, standards and drawings specified in the contract documents, covers the requirements for all work associated with the construction of a new Remote Transmitter Receiver (RTR) communication facility to serve Earnest A. Love Field, also known as Prescott Regional Airport, in Prescott, Arizona. The contractor shall furnish all labor material and equipment in strict accordance with the contract document. Additional labor, materials, equipment, and/or appurtenances not specifically detailed or specified, but required to complete the project, shall be provided by the Subcontractor if any as an integral part of the scope of work specified.

#### **1-1.2 Scope of Work:**

The following items are a brief summary of the project and are provided solely for the purpose of revealing the general nature of the work involved. The contractor is responsible for accomplishing all items of work in accordance with the applicable drawings, specifications and conditions of the subcontract. Any additional labor, materials, equipment, and/or appurtenances not specifically detailed or specified, but required to complete the project, shall be provided by the Subcontractor as an integral part of the scope of work specified.

##### **A. New Antenna Array Site:**

1. Assemble and install three Jaquith tilt down RCAG antenna assembly with air terminals and obstruction lights.
2. Install new foundations to support each tilt down mast.
3. Install a new grounding counterpoise around the new tilt-down antenna array.
4. Install a new concrete encased duct bank with a pullbox as shown on the plans.
5. Install 7/8" RF cable in the new duct bank for termination by others (both ends).
6. Construct a new unistrut backboard by each tilt-down antenna mast.
7. Install electrical equipment on the new backboard.
8. Install new power cables and energized the obstruction light on top of the mast.
9. Cover the lease plot with ¾" class 2 road base materials.

##### **B. AFSS Exterior Work:**

1. Install a large junction box on the west wall of the building.
2. Install one - 4" RSC conduits from the large junction box, and penetrate the wall.
3. Install a small junction box on the west wall for the power cable (obstruction light) going to the antenna array.
4. Install a pullbox in the AFSS parking lot.
5. Pavement work such as asphalt saw cutting and asphalt patching work.

6. Install 1 ton ¾” crush rock.

C. AFSS Interior Work.

1. Extend the cable tray in the telco room to the new wall penetration.
2. Install conduit to power panel L- 1 in the e/g room.
3. Provide 2-pole 30 amp breaker.
4. Wire the new obstruction light power

**1-1.3 Contractor Furnished Material:**

The contractor shall furnish all labor, material and equipment in strict accordance with this specification and the contract drawings. The Contractor shall supply all materials not specifically listed on the Government Furnished Property List. Such items include but not limited to the following:

- Concrete foundations including anchors, bolts, nuts, and washers and miscellaneous hardware.
- All power cables.
- All conduits such as rigid steel, PVC, liquid tight flex conduit including fittings and pullboxes.
- Lightning protection equipment such as lightning rods, clamps, down conductor, etc.
- All grounding wires noted on the plans.
- All enclosures and junction boxes.
- All fasteners such as nuts, bolts, washers, cable grips, threaded rods, lock nuts, and other miscellaneous hardware.
- Electrical equipment such as power panel, breakers, and surge assessor.
- Resources to pick up, and transport government owned material to the job site.
- Fill material in excess of that excavated from cut areas.
- Resources to conduct all required testing including but not limited to concrete strength tests, electrical megger tests, and electrical continuity tests

**1-1.4 Government-Furnished Material (GFM):**

The essential items furnished by the Government are listed below. This list however does not include a breakdown of the various hardware, fasteners and components provided with the item. These components are listed on the “Parts List” on the appropriate vendor shop-drawings. Items not listed on the parts list but necessary for the installation shall be contractor furnished.

- Tilt Down Mast assembly, consisting of (a) mounting frame assembly, (b) stand plate assembly, (c) stabilizer rod assembly, (d) horizontal stabilizer rod assembly, (e) fiberglass tube, (f) L2817 top cap, (g) cross bar assembly, (h) anchor bolts mounting frame, (i) anchor plate and (j) lowering winch. Qty – 3 systems.
- 7/8” LDF5-50A Foam Heliac Cable. The exact quantity to be determined. The government will supply enough cable so 16 separate individuals runs ( 6 runs to mast #1 & 3 and 4 runs to mast #2) can be pulled from the AFSS building

- Junction Box: 24" x 24" x 12" stainless steel, 4X enclosure. Qty -3.
- Junction Box 12" x 12" x 8" stainless steel, 4X enclosure. Qty -5
- Junction Box: 36' x 48" x 12" dp continuous hinge two door stainless steel enclosure, 4X. Qty-1.

### **1-1.5 Safety during Construction:**

The contractor shall comply with Advisory Circular 150/5370-2E "Operational safety on Airport during Construction" in the execution of this contract.

**1.1.6 Conflict in Contract Documents:** The most stringent requirement shall govern should there be a conflict between requirements in the contract documents.

### **1-1.7 Special Precautions:**

- Any activities using large construction equipment, which may pose an obstruction such as backhoes, cranes etc. must be performed at night. Requirements for the said activity are stipulated in the FAA project risk management.
- Existing underground cables and ducts are shown on drawings in their approximate locations only and other cables and utility lines not shown may exist where underground construction is required. Information shown on the drawings regarding cable location, size and number has been obtained from various construction drawings, and the accuracy and completeness are not guaranteed.
- Prior to commencing construction, the Contractor shall consult with local FAA, Utility and Airport personnel regarding information on all underground lines. If the Contractor should damage such underground lines, he shall repair the lines at once to the satisfaction of the owner at the contractor's own expense.

**1-1.8 Acronyms:** The list below contains common acronyms that are used throughout this specification.

A.O.A.	Airport Operations Area
BC	Bare Copper
CFM	Contractor Furnished Material
EES	Earth Electrode System
GFE	Government Furnished Equipment
GFM	Government Furnished Material
MSL	Mean Sea Level

NTP	Notice to Proceed
OB	Obstruction Light
RSA	Runway Safety Area
RWY	Runway
R/W	Runway
RTR	Remote Transmitter Receiver

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## **DIVISION 1 - GENERAL REQUIREMENTS**

### **SECTION 1-2**

#### **SITE ACCESS, CONSTRUCTION LIMITS, USE OF FACILITIES AND WORK HOURS**

##### **1-2.1 Construction Limits, Access, and Use of Facilities:**

**1-2.1.1 Construction Limits:** The Contractor shall confine operations, activities, storage of materials and employee parking within designated areas. Additional space the Contractor deems necessary shall be obtained off site, at no additional cost to the government. The Contractor shall avoid equipment from entering onto the runway or taxiway surfaces.

**1-2.1.2 Access to Sites:** Access to the work sites shall as discussed during the preconstruction conference that will be held prior to the start of construction.

**1-2.1.2.1 Communication:** The Contractor or his construction foreman will be required to have in his possession at all times while working within the runway and taxiway critical area or within the safety area(s) a two-way ground to ground radio for communicating with the Air Traffic Control Tower.

**1-2.1.2.2 Vehicle Marking:** Construction vehicles/equipment operating within the AOA (Airport Operation Area) shall be marked with a flag that is readily visible. The flag shall be a minimum of 3 foot square having a checkered pattern of International Orange and white squares-at least 1 foot on each side. At least one construction vehicles operating within the vicinity or project area of each other shall be equipped with a two way radio as indicated in 1-2.1.2.1.

**1-2.1.2.3 Vehicle Lighting:** A vehicles/equipment operating within the runway and taxiway safety areas shall be equipped with a yellow flashing beacon mounted on the uppermost part of the vehicle such that is conspicuous from any direction. This vehicle/equipment shall also be equipped with a two way radio as indicated in 1-2.1.2.1.

**1-2.1.3 Contractors' Use of Premises:** Unless otherwise indicated, the Contractor shall have complete and exclusive use of the premises within the construction staging area limits for the execution of the work.

**1-2.1.3.1 Damage to Site:** Damage to existing roads, etc. caused by the Contractor's activities shall be repaired. Avoid traffic of heavy equipment on existing asphalt pavements. All costs of repairs shall be paid by the Contractor.

**1-2.1.3.2 Protection:** Contractor shall assume full responsibility for the protection and safekeeping of all project material, Government-Furnished as well as Contractor-Furnished, stored on the site.

1-2.1.3.3 Debris Removal: The Contractor and Subcontractors shall maintain the job site in a neat and orderly condition. This includes the daily removal of rubbish, waste and tools, equipment and materials not required for the work in progress. The Contractor shall prevent any debris from leaving the limits of construction and causing possible hazards to aircraft or airport operations.

1-2.1.4. Barricades, Signs, and Hazard Markings: The contractor shall provide, erect and maintain all necessary barricades, signs, danger signals, and lights for the protection of the work and the safety of the public for both land and air traffic. Areas closed to aircraft traffic shall be protected by effective barricades and signs shall be illuminated at night. Barricades, lights, and signs shall be weighted against aircraft blast and shall have a maximum spacing of 50ft.

## **1-2.2 Government (Federal Aviation Administration) Rights:**

1-2.2.1 Government Use and Access to Premises: The Government reserves the right to enter the premises during the term of the contract for quality assurance inspections and for the maintenance of existing navigational and communication facilities.

1-2.2.2 Inspection: It shall be the contractor's responsibility to provide/allow the FAA COTR to inspect all work accomplished under this contract. No work shall be concealed, enclosed, or backfilled without the FAA COTR's approval. If work is concealed, enclosed, or backfilled without inspection and approval from the COTR, the contractor shall be responsible for all expense and work required to open and restore the concealed area(s) for inspection.

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## **DIVISION 1 - GENERAL REQUIREMENTS**

### **SECTION 1-3**

#### **COORDINATION, LOCAL PERMITS, INSURANCE, AND TESTING**

##### **1-3.1 Coordination:**

**1-3.1.1 Project Coordination:** The Contractor shall maintain a schedule of work and work layout to resolve conflicts and to ensure coordination of the work by different trades. It shall be the Contractor's responsibility to resolve all coordination conflicts between subcontractors and other trades.

**1-3.1.1.1 Coordination Meeting:** Prior to the start of the construction, a preconstruction conference shall be held between the contractor, FAA, and the Airport. The Contractor shall submit the work schedule and work layout at this meeting. This meeting shall be arrangement by the FAA and the date, time, and location of this meeting shall be announced.

**1-3.1.2 Coordination with the Airport:** The Contractor shall contact the Airport to obtain detailed instructions for: Job Site Operations, Construction Activity and Airport Movement, Existing Buried Cables, Ducts and Other Utilities, Work in Critical Areas, Work by Other Contractors, Control of Dust, Workers Background Check, Job Site Security, Identification Badges, Ramp Permits, Gate Cards and Private Vehicle Parking. The Contractor shall allow for sufficient time to satisfy the above items without causing delays to the actual work.

##### **1.3.2 Permits:**

**1-3.2.1 Local Permits:** The Contractor shall apply, pay fees, etc., to obtain applicable local permits and inspections as required. The Contractor shall obtain the required permits in sufficient time to prevent delaying the project completion. In addition to the project plans and specifications, all work shall comply with the Uniform Building Code/1994 Edition, the National Electric Code/1993 Edition, and all applicable local codes. In addition, the Contractor shall secure approval or submit for review and comply as required with all conditions imposed by federal, state, and local governmental agencies having jurisdiction. Copies of all permits and other inspection reports required by local agencies shall be submitted to the COTR.

##### **1-3.3 Airport Insurance & Badging Requirements:**

**1-3.3.1 Airport Insurance and Badging Requirements:** The contractor is expected to be fully badged so he/she has full-unrestricted access to the project site. In order to meet this requirement the contractor shall be required to meet the Airports' security badging and motor vehicle operating requirements. The state's minimum auto liability insurance is required.

1-3-3.1 Driver Training: Driver training is required for any person operating a vehicle on the movement areas of the airport. Additionally, the vehicles must meet the marking, lighting and communication requirements of the airport. Vehicles must be marked with the company name in minimum of 3” high letters or a company logo minimum 12” diameter. Vehicles must be marked with a flag and/or light in accordance with FAA requirements and vehicles must have two way radio communication capabilities with the tower.

The form required for those desiring driver training is located at [http://www.prescott-az.gov/\\_d/2010-11drivercredentialapp.pdf](http://www.prescott-az.gov/_d/2010-11drivercredentialapp.pdf) Page 2 will be completed by the FAA, and the individuals will need to bring 2 forms of identification.

Driver training is offer every other Tuesday at 11:00 a.m. The training typically takes between 1 1/2 hours and 2 hours. And there is a \$20 fee, cash or check only .

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## **DIVISION 1 - GENERAL REQUIREMENTS**

### **SECTION 1-4**

#### **SUBMITTALS**

**1-4.1 General:** This section covers the procedure and requirements of all submittals. Detailed submittal requirements are outlined in the applicable section of these specifications.

**1-4.2 Submittals Requirements:** At a minimum, the following submittal items must be provided to the Contractor for review and approval prior to installation:

- a. Construction Progress Schedule.
- b. Schedule of Values.
- c. SSSP.
- d. QCP.
- e. Master Submittal List.
- f. Schedule of Material Allowance.
- g. Substitutions and all requested changes.
- h. Underground power and control cables.
- i. Concrete mix design.
- j. Crushed rock surfacing sieve analysis.
- k. Electrical panels and switches.
- l. Material safety data sheets.
- m. Lightning protection materials.
- n. Precast concrete handhole and cover.
- o. Pre-Installation and Work Plans.
- p. Junction boxes

The list shall not be considered conclusive. The COTR may request at his or her discretion submittals for additional items. If should this be the case, the contractor shall provide the submittal(s) within five working days after the request is made.

All submittals listed above must be approved by the COTR before the preconstruction conference.

#### **1-4.3 Requirements:**

All material used in the work shall be inspected, tested, and approved by the COTR before installation. Any material purchased and installed without approval or written permission by the COTR shall be at the contractor's risk. Materials found to be unacceptable and unauthorized if directed by the COTR shall be removed at the contractor's expense.

1-4.3.1 Definition: Where the word "Submittal" is used to refer to shop drawings, samples, manufacturer's catalog cuts, technical data, specifications, installation instructions, material lists, test reports, certificates, guaranties, operation and maintenance manuals, and as-built drawings.

1-4.3.2 Approval: Samples, certificates, test reports, and shop drawings shall be submitted to the COTR in advance for a determination of specification compliance before materials are delivered at the site. The time necessary for FAA review of the contractor's material submittals is at least ten (10) calendar days after receipt. All materials installed in the work shall match the approved submittal. After a submittal has been approved, the Contracting Officer will not permit a substitution without written approval from the COTR. Any disapproved submittal must be re-submitted within ten (10) calendar days. Unless otherwise specified, number of copies of submittals shall be as follows:

Samples: As specified in each section.  
Certificates, Test Reports, Warranties, etc.: 3 copies  
Shop Drawings, Manufacturer's Brochures: 6 copies  
Installation Instructions: 3 copies  
Maintenance Manuals: 3 copies  
As Built Drawings: As specified hereinafter.

1-4.3.3 Certification of Compliance: All material submittals shall be accompanied by the manufacturer's certificate of compliance stating that such material fully complies with the requirements of this contract. The certificate shall be signed by the manufacturer. At any time should certified materials found not to conform to the contract requirements even though approved by the COTR, the material shall be subject to rejection whether in place or not.

When a material is specified by "brand name or equal" and the contractor elects to furnish the "brand name" product, a certificate of compliance for that material is not required. Should the contractor propose to furnish an "or equal" product, the contractor shall furnish the manufacturer's certificate of compliance that the material exceeds or meets the brand name product. However, the COTR shall be the sole judge as to whether the "or equal" product is acceptable for use.

The COTR reserves the right to reject the use of a particular material based on the certificate of compliance.

1-4.3.4 Shop Drawings: The term "Shop Drawings" includes drawings, diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data, and similar materials furnished by the Contractor to explain in detail specific portions of the work required by the contract.

a. The Contractor shall coordinate all such drawings and review them for accuracy, completeness, and compliance with contract requirements and shall indicate his approval thereon as evidence of such coordination and review. Shop drawings submitted to the Resident Engineer without evidence of the Contractor's approval may be returned for re-submission. The Resident Engineer will indicate his approval or disapproval of the shop drawings and if not approved as

submitted shall indicate his reason therefore. Any work done prior to such approval shall be at the Contractor's risk. Approval by the Resident Engineer shall not relieve the Contractor from responsibility for any error or omissions in such drawings, nor from responsibility for complying with the requirements of this contract, except with respect to variations described and approved in accordance with paragraph c. below.

b. If shop drawings show variations from the contract requirements, the Contractor shall describe such variations in writing separate from the drawings, at the time of submissions. If the Contracting Officer approves such variations, an appropriate contract modification shall be issued, except that, if the variation is minor and does not involve a change in price or in time of performance, a modification need not be issued.

c. The Contractor shall submit to the COTR for approval five copies (unless otherwise indicated herein) of all shop drawings as called for under various headings of these specifications. Four sets of all shop drawings will be retained by the Resident Engineer and one set will be returned to the Contractor.

**1-4.3.5 Operation and Maintenance Manuals:** Provide two copies of the operation and maintenance manuals for all apparatus and equipment furnished under the contract, including but not limited to machinery, HVAC equipment, plumbing equipment, electrical apparatus, and controls.

a. Contents shall include manufacturer's instructions for installation, startup, operation, inspections, maintenance, parts lists including recommended spare parts, guarantees and warranties, and data sheets showing model numbers of equipment furnished. Complete electrical schematic and connection diagrams shall be provided for each particular motor control or other electrical system. Standard diagrams will not be acceptable.

b. Operation and Maintenance Manuals shall be bound in three ring binders, 2-inch size, with covers. The manuals shall show names, address and phone number of the nearest service facility.

**1-4.4 Progress Schedule:**

The contractor shall submit a construction schedule as specified in Division 1-12 to the COTR for review and approval.

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## DIVISION 1 - GENERAL REQUIREMENTS

### SECTION 1-5

#### TEMPORARY FACILITIES

1-5.1 General: Contractor shall provide and pay for all temporary services and facilities as specified below and as necessary for the proper and expeditious execution of the work. Contractor shall make, or have made, all connections to existing services and sources of supply as necessary and/or indicated at contractor's own expense. Contractor shall provide all labor, materials, equipment and appurtenances necessary for the complete installation, operation and maintenance of all temporary service systems and facilities. All work under this Section shall comply with applicable laws, rules, regulations, codes, ordinances and orders of all federal, state and local authorities having jurisdiction for the safety of persons, materials and property. Contractor shall remove all such temporary installations and connections when no longer necessary for the project work.

1-5.2 Temporary Electric Lighting and Power: The contractor shall make all necessary arrangements for temporary electrical power with the local power company to provide and pay for all temporary work or, at Contractor's option, Contractor shall provide an approved temporary engine generator at the project site for construction support. **CONTRACTOR WILL NOT BE PERMITTED TO USE FAA FURNISHED ELECTRIC SERVICE FOR THE INSTALLATION.**

1-5.3 Temporary Water: Contractor shall make arrangements to transport all necessary water for construction and drinking purposes.

1-5.4 Temporary Toilets and Sanitation: Contractor shall provide ample and suitable on-site sanitary conveniences with proper enclosures for the use of the workers employed on the work. Such conveniences shall be kept clean, be properly ventilated and shall be installed and maintained in conformity with requirements of all laws and ordinances governing such installations. Locations shall be subject to approval by the COTR. After completion of the work such conveniences shall be removed from the site.

1-5.4.1 Toilets: Toilets shall be portable chemical-type with screened enclosures, each having a urinal and closet and mounted on skids. Not less than one unit shall be provided for every 25 full-time employees.

1-5.4.2 Toilet Servicing: Contractor shall be responsible for paving and arranging for each toilet unit to be serviced at least twice a week, including removal of waste matter, sterilizing, recharging tank, refilling tissue holders, and thorough cleaning and scrubbing of entire interior.

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## **DIVISION 1 - GENERAL REQUIREMENTS**

### **SECTION 1-6**

#### **MATERIALS AND EQUIPMENT**

**1-6.1 General:** Material and equipment incorporated into the work shall conform to applicable specifications and standards and comply with size, make, type and quality specified, or as specifically approved in writing. Manufactured and fabricated products shall be designed, fabricated and assembled in accordance with the best engineering and shop practices. Like parts of duplicate units shall be manufactured to standard sizes and gauges and shall be interchangeable. Two or more items of the same kind shall be identical and manufactured by the same manufacturer. Products shall be suitable for service conditions. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing. Do not use material or equipment for any purpose other than for which it is designed or specified. Furnish and install products specified, under options and conditions for substitution stated in this Section.

**1-6.2 Manufacturer's Instructions:** When contract documents require that installation of work shall comply with manufacturer's printed instructions, copies of such instructions shall be distributed to parties involved in the installation, including two copies to the FAA. The Contractor shall maintain one set of complete instructions at the job site during installation and until completion. Products shall be handled, installed, connected, cleaned and conditioned in strict accordance with such instructions and in conformity with specified requirements. If job conditions or specified requirements conflict with manufacturer's instructions, the Contractor shall consult with the manufacturer for further instructions. All work shall be performed in accordance with manufacturer's instructions. No preparatory step or installation procedure shall be omitted unless specifically modified or exempted by contract documents.

**1-6.3 Transportation and handling:** Products shall be delivered in undamaged condition, in manufacturer's original containers or packing, with identifying labels intact and legible. Shipments shall be inspected to ensure compliance with requirements of contract documents and approved submittals, and that products are properly protected and undamaged immediately on delivery. Provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packing.

**1-6.3.1 Delivery of Contractor Furnished Materials:** The Contractor shall give notice to the COTR and to the Airport Operations personnel at least 48 hours before materials are moved onto the airport. Routes of travel on airport property to be used to transport materials to and from the construction site shall be coordinated with Airport representatives. The Contractor shall have personnel at the project site to receive all material being shipped by delivery vehicles. Local FAA personnel are not responsible for signing off on deliveries of Contractor Furnished Material. Delivery of Contractor Furnished Material will not be accepted by any Federal Government personnel.

1-6.4 Storage: Materials shall be stored in accordance with manufacturer's instructions, with seals and labels intact and legible. Materials subject to damage by the elements shall be stored in weather-tight enclosures. Temperature and humidity shall be maintained within the ranges required by the manufacturer's instructions. Fabricated products shall be stored above the ground, on blocking or skids to prevent soiling or staining. Products which are subject to deterioration shall be covered with impervious sheet coverings and adequate ventilation shall be provided to avoid condensation. Loose granular materials shall be stored in a well-drained area on solid surfaces to prevent mixing with foreign matter.

1-6.4.1 Storage Location: Locations for the storage of materials shall be coordinated with the Airport.

1-6.5 Proprietary Names: Whenever proprietary names are used in this specification for material or equipment, such names shall be construed as a standard to establish quality and accurately define the material or equipment. Another make or item may be approved provided it is equal or better than the specified manufacturer. All materials and equipment that is supplied by the Contractor shall meet the required salient characteristics that is specified.

1-6.6 Substitutions: A separate request for each substitution shall be submitted. Each request shall be supported with complete data substantiating compliance of proposed substitution with the requirements stated in the contract documents. Each request shall include product identification, manufacturer's literature including address, product description, reference standards and performance and test data. Samples shall be submitted as applicable.

An itemized comparison of the proposed substitution with the product specified shall be included. The following information shall also be included: data relating to changes in the construction schedule; list of changes required in other work or products; and accurate cost data.

Substitute products shall not be ordered or installed without written acceptance. In making a formal request for substitution, the Contractor represents that the proposed products are equal to or superior in all respects to that specified; that the warranties or bonds for substitutions will be provided as for product specified; that installation of accepted substitution will be coordinated into work to be complete in all respects; that claims for additional costs caused by substitution which may subsequently become apparent be waived; and that cost data is complete and includes related costs under the contract.

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## **DIVISION 1 - GENERAL REQUIREMENTS**

### **SECTION 1-7**

#### **CONTRACT CLOSEOUT**

**1-7.1 General:** The Contractor shall require each sub-contractor engaged upon the work to bear full responsibility for cleaning up during and immediately upon completion of their work. All rubbish, waste, tools, equipment and other apparatus caused by or used in the execution of their work shall be removed. This shall in no way be construed to relieve the Contractor of the primary responsibility for maintaining the building and the site clean and free of debris, and leaving all work in a clean and proper condition.

All exposed floor surfaces shall be protected against all mechanical damage, mortar or plaster droppings, oil, grease, or other damage that will stain or soil the finish. Protection shall be maintained until all work has been completed and work has been officially accepted.

**1-7.1.1 Rubbish Removal:** Immediately after unpacking, all packing material, case lumber, wrappings, or other rubbish, flammable or otherwise, shall be collected and removed from the building and the premises.

**1-7.1.2 Overall Cleaning:** Immediately before the final inspection, the entire exterior and interior of the building and the surrounding areas shall be thoroughly cleaned by the Contractor, including but not limited to the following:

- (a) All construction facilities, debris and rubbish shall be removed from the building and the site.
- (b) All finished surfaces within the building shall be swept, dusted, vacuumed, washed or polished as required.
- (c) All tools, scaffolding, temporary utility connections or buildings, belonging to the Contractor or used under his direction shall be removed from the site.

**1-7.2 Completion of Work:** Prior to submitting completion certificate, the Contractor shall place all apparatus furnished and installed under the contract into successful operation according to manufacturer's instructions, including lubrication and making of all required adjustments and testing and operation checks.

**1-7.2.1 Completion Certificate:** When the Contractor considers the work is complete, he shall submit a signed certification that the contract documents have been reviewed; work has been inspected for compliance with contract; equipment and systems have been tested and are operational; required operational and maintenance manuals, data and parts list have been submitted and approved; spare parts have been provided as required; shelter manual has been

prepared and found acceptable; and work is completed, premises cleaned and ready for inspection. The typed certification shall be signed by the Contractor and submitted

**1-7.3 Contractor Acceptance Inspection (CAI):** The FAA shall schedule the final inspection upon approval and endorsement of the Contractor's Completion Certification. The Contractor shall have the superintendent present at the CAI. The FAA shall conduct an inspection of the facility to verify all contract conditions are met. The FAA reserves the right to have local FAA personnel conduct tests to verify that operational requirements are met.

**1-7.4 Punch List:** The FAA shall furnish the Contractor with a list of discrepancies in the work, material and equipment noted during the final inspection.

**1-7.5 Final Acceptance of Work:** The Contractor shall correct discrepancies noted during the final inspection, clean the premises and notify the FAA that the work is ready for acceptance. The FAA will verify that all discrepancies have been corrected. The Contracting Officer makes final acceptance.

**1-7.5.1 Warranty:** The contractor shall provide a written 1-year warranty guaranteeing all work and materials installed under this contract. The warranty shall cover all parts and labor against defective parts or workmanship necessary to repair or bring into proper operation. The warranty shall start upon acceptance of all work by the COTR. The FAA will withhold final payment until receipt of the warranty.

**1-7.5.2 Contractor's As-Built Construction Drawings:** The Contractor shall maintain, correct and protect at least two sets of contract drawings and specifications during this contract. These drawings shall include all changes whether initiated by contract modification, changed conditions, mutual consent, shop drawings or submittal data, "as-built" conditions, etc. One set of these drawings shall be used for layout during construction progress by all trades. Within 5 calendar days after installation and/or construction work is complete, these two sets of drawings and specifications shall be submitted to the Contracting Officer as "as-built" drawings.

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## **DIVISION 1- GENERAL REQUIREMENTS**

### **SECTION 1-8**

#### **SURVEYING**

**1-8.1 General:** This section covers the requirements for the Contractor to provide surveying resources for the project.

**1-8.1.1 Work Included:** The Contractor shall furnish surveying resources to accomplish the work listed below.

- a. Layout of the work. The Contractor shall furnish and install a sufficient amount of stakes and survey nails to properly layout general work, lease boundaries, reference points and to provide horizontal and vertical control as needed.
- b. Determine existing site elevations as indicated on the project drawings.
- c. Layout all cable runs junctions and turns. The cable run shall be marked every 100'. The distance from the centerline to the cable run shall be measured.

#### **1-8.2 Surveying:**

**1-8.2.1 Surveying Personnel:** The surveyor shall be a licensed professional surveyor experienced and familiar with the type of work involved. The land surveyor shall be licensed in the state where the work is being performed.

**1-8.3 Conducting Survey Work:** The contractor shall coordinate all surveying activities on the airport with airport authorities and air traffic personnel. The contractor shall be responsible for coordinating for access onto runways and taxiways. Night work may be required.

- a. The surveyor shall layout its work from established airport or facility base lines and benchmarks and/or as indicated on the drawings. Subcontractor shall be responsible for all measurements in connection with the layout. The Surveyor shall furnish, at its own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to layout any part of the Work. The Surveyor shall be responsible for the execution of the Work to the lines and grades specified in the Contract Documents or as indicated by the COTR.
- b. The Surveyor shall establish and maintain a minimum of two permanent benchmarks on the Worksite, referenced to data established by survey control points, and record benchmark locations with horizontal and vertical data on project Record Documents.

- c. The Surveyor shall be responsible for maintaining and preserving all stakes and other marks until authorized to remove them.
- d. The Surveyor shall establish the horizontal control for the system layout, access roads, facility plot, foundations, and light stations. All cable runs shall be marked at a minimum of 200 foot stations, at all turns, and at all junctions or hand holes. The distance from the centerline of any adjacent runway to the cable run shall be determined and recorded on the Record Drawings if such dimensioning is shown on the Contract Drawings.
- e. The Surveyor shall take elevation readings of the tops of new concrete foundations. Surveyor shall record all elevation readings and submit them to the COTR.

**1-8.4 Quality Assurance:** The Contractor shall leave all survey hubs in place until work has been verified. If deemed necessary, the Contractor shall supply one laborer to assist in verifying all surveying work.

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## **DIVISION 1 - GENERAL REQUIREMENTS**

### **SECTION 1-9**

#### **RUNWAY SAFETY REQUIREMENTS**

**1-9.1 General:** This project work requires Contractor activity on an operating airport. The Contractor shall coordinate all work with Airport. The Contractor shall provide all radio communications necessary to control vehicles, construction equipment and personnel involved with the construction activity.

**1-9.1.1 Aircraft Operation:** The Contractor shall use extreme caution to avoid endangering or impeding the movement of any aircraft on runways, taxiways and aprons. During the time that the Contractor is performing the work, the aprons, taxiways and runways at the airport will remain in use by aircraft.

Aircraft operations, unless otherwise directed, shall have priority over all contractor activity. The Contractor shall not allow employees, subcontractors, material suppliers or any other personnel under Contractor control to enter or remain upon any part of the airport which would be a hazardous location to aircraft.

Should aprons, runways or taxiways be required for use of aircraft, and should the Contractor be too close to the portion used by aircraft for safety, it may be necessary to order the Contractor to suspend all operations and remove equipment and material until further notice.

**1-9.2 Applicable Documents:** The current issues of the following documents in effect on the date of the invitation for bid form a part of this specification and are applicable to the extent specified herein. The most stringent requirement shall govern should there be a conflict between requirements.

- A/C150/5370-2                      Operational Safety on Airports during Construction

**1-9.3 Airport Operations Rules:** The exact details for safety, movement of vehicles, method of control, etc. shall be discussed in depth at the preconstruction meeting. As a minimum however, the Contractor shall observe the rules listed below and the requirements listed in the applicable documents. The FAA reserves the right to add additional safety rules if deemed necessary by the Airport Authority or Air Traffic Personnel. The most stringent requirement shall govern should there be a conflict between requirements.

**a. Work inside the Runway Safety Area (RSA):** Construction within the limits of the RSA is prohibited while the full length of the runway is open. RSA dimensions are as follows:

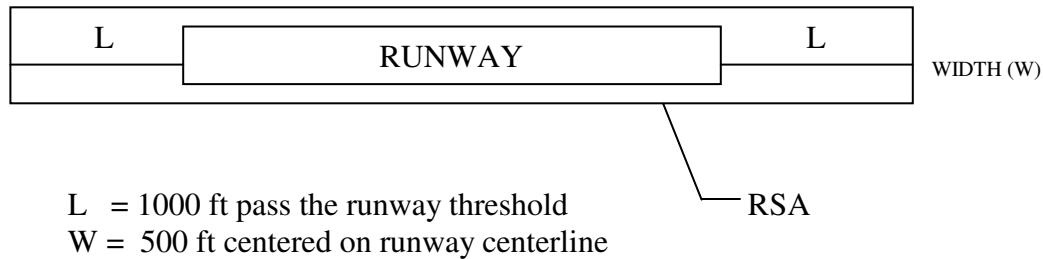


Figure 1: Runway Safety Area (RSA) Dimensions

Construction activity within the RSA will require temporary closing of the runway (displace threshold) or completely closing the runway.

b. Work Near Runway: Men, equipment, or other construction related material will be permitted in the approach or departure zones of active runways provided that the construction activity is conducted below a 50:1 approach plane originating 200 ft from the end of the runway. Any construction activity that violates the approach zone will require special consideration such as obstruction marking.

c. Excavations: Trenches and foundation excavations within the RSA and with 300 feet off the operating taxiways shall not be left open overnight. Work that requires trenching or excavation within these areas shall be conducted in an expeditious and efficient manner. Instead of backfilling, the Contractor may use steel plates to cover the trench or excavation. The steel plates must be of sufficient thickness to match the pullbox loading (160,000 pounds). The Contractor shall obtain approval before using the steel plate option.

d. Obstruction Marking: All equipment on the field shall be properly marked with orange and white checkered flags of a size not less than three square feet during the day. All equipment to be used during nighttime activity shall be furnished with amber flasher electric lights capable of a 360 degree rotation.

e. Pullboxes in the Runway Safety Area: Unless noted otherwise on the plans, all pullboxes located inside the runway safety area shall be aircraft rated with a capacity of 160,000 pounds. Aircraft rated pullboxes shall also be installed at location shown on the project drawings.

f. Pullboxes outside the Runway Safety Area: The loading requirements for pullboxes outside the runway safety area are indicated on the plans.

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## **DIVISION 1- GENERAL REQUIREMENTS**

### **SECTION 1-10 OSHA SAFETY REQUIREMENTS**

**1-10.1 General:** The Contractor shall comply with the latest Occupational Safety and Health Administration regulations regarding safety in the work area. This section is intended to cover limited requirements of the OSHA Construction Standard. The Contractor is not relieved from adhering to other OSHA requirements not listed hereinafter. The Contractor shall consult the latest referenced OSHA documents for safety regulations.

#### **1-10.2 Applicable Documents:**

OSHA 29 CFR 1926

OSHA 29 CFR 1910

#### **1-10.3 General Safety Provisions:**

**1-10.3.1 Site Specific Health and Safety Plan (SSHSP):** The contractor shall comply with the applicable sections of 29 CFR 1910 and 29 CFR 1926 together with other state and local requirements. As part of those requirements, the contractor shall prepare a SSHSP.

**1-10.3.1.1 "SITE SPECIFIC" Occupational Health and Safety Plan:** should have as a minimum the following information:

- a) Subcontractor name and phone number.
- b) Dates for work to be accomplished.
- c) Brief description of scope of work (1-2 sentences is okay).
- d) Facility location and work release # (Work release # to be provided by FAA).
- e) Include official title and name and telephone number of the supervisor on site, competent person, safety person or person responsible for doing safety at the FAA or work site where work will be done. Also the RE's name or FAA contact's name and telephone number should be listed in the plan.
- f) Specifics to the project regarding work place safety programs but **not limited to:**
  - 1. Confined space
  - 2. Machine Guarding
  - 3. Excavation, trenching, shoring
  - 4. Welding, cutting and brazing – Hot work Program and Permit required
  - 5. Ladders platforms, walkways, scaffolds, man lifts
  - 6. Lockout/ Tagout
  - 7. Non-ionizing and ionizing radiation
  - 8. Hand and power tool safety
  - 9. Power Actuated or fuel actuated tools
  - 10. Lead safety
  - 11. Asbestos safety
  - 12. Ergonomics

- 13. Powered and industrial trucks
- 14. Electrical safety
- 15. Biological hazards
- 16. Fall protection
- 17. Compressed Gases
- 18. Storage of materials/ haz mat and Disposal of regular waste/hazardous waste
- 19. Cranes and Derricks
- g) Specifics to the project regarding Personnel Safety
  - 1. Accidents/ Damage Reporting
  - 2. Hearing conservation
  - 3. Respiratory safety
  - 4. Bloodborne Pathogens
  - 5. Medical surveillance
  - 6. Recording keeping
  - 7. Personal Protective Equipment or Gear ( PPE or PPG )
  - 8. Heat/cold stress
  - 9. Vehicle safety
  - 10. HAZCOM and all
  - 11. First aid requirements
  - 12. Job Hazard Analysis (JHA) or Job Safety Analysis (JSA)
- h) Specifics to the project regarding Fire Life safety and Emergency Preparedness.
- i) List of transportation and disposal agencies that will be used for this work.
- j) Employee certificates of medical surveillance.
- k) Employee certificates of respirator fit testing.
- l) Employee certificates of 40 hour hazardous waste health and safety training/eight (8) hour refresher.
- m) A preplanned construction safety talk given to workers prior to commencement of a new phase of construction (i.e. trenching, crane operations, etc.), which explains the particular hazards and outlines protective measures to prevent accidents.
- n) Regulations governing the use and location of personal protective equipment, fire extinguishers, and first aid.
- o) Scheduling on-site safety inspections. Use a systematic approach with a written checklist that is kept on record.
- p) Posting telephone numbers for Ambulance, Hospitals, Police, and Fire Departments, along with a strip map to each, near a telephone in a location accessible to all personnel.
- q) A plan to effectively and safely react to lightning, rain/flooding, high winds, earthquakes, vehicle and plane crashes.
- r) An accident investigation plan to effectively determine the causes and prevent future accidents.

**1-10.3.1.1.2 MINIMUM REQUIREMENTS:** The following areas shall be provided for on the construction site and included in the safety plan as conditions dictate:

- a) Personal protection including hard hats, protective footwear, eye protection, respiratory protection, work gloves and hearing protection.
- b) Proper class of fire extinguisher provided.

- c) First Aid plan including trained personnel, supplies and equipment, eyewash or shower, emergency transportation and first aid log.
- d) Shoring for all excavations not in solid rock over five feet deep. Identify type of shoring to be used. Established procedures in case of cutting a power or gas line.
- e) Instructions for handling heavy materials in a safe manner.
- f) Electric tools in good working condition and properly grounded. Daily inspections. Use "lock-out" procedures when working on electric services.
- g) Crane operations in safe manner clear of overhead power lines and within safe lifting capacity of crane.
- h) Ladders in good working condition and of proper size and type for the task.
- i) Scaffolding must be complete and in new or like new condition with sills, base plates, leveling jacks, cross bracing, scaffold grade lumber, guard rails, toe boards and have safe access provided.
- j) Personnel will be tied off with a shock impact reduction system when climbing towers.
- k) Work area policed daily or more often as required to keep area safe from debris and potential falling objects.
- l) Hazardous materials shall be properly labeled, controlled and used by trained personnel only.
- m) Care and monitoring shall be used when workers are in confined spaces. Hazards may include oxygen deficiency, toxins, fire/explosions, electrical, contact with mechanical equipment and falls.
- n) Asbestos control program including detection of asbestos, assessment of exposure potential, control of the hazard, posting of notification requirements when such a hazard is present and record keeping.
- o) Hearing conservation program for steady noise and impact noises.
- p) Proper shielding and protective clothing when working near energized Radars.
- q) Observe proper safety rules when welding and using exothermic weld Use eye, skin and hand protection, and make sure area is clear of other workers.
- r) Post insurance certificate, notice to employees as required and the name/phone number of the RE.
- s) On airports pay particular attention to assuring operational safety and coordinating with all airport authorities.

**1-10.3.2 Site Specific HazCom Plan:** The contractor shall comply with all applicable sections of 29 CFR 19190.1200, the Federal Hazard Communication (HAZCOM) standard which require that information, training, and record keeping provisions be implemented to ensure that all potential affected employees are made aware of pertinent "right to know" requirements associated with chemicals and other materials that are used, stored, or brought into the work places. As part of those requirements, the contractor shall prepare a HAZCOM plan. The written plan shall include the followings:

- a) Provide the names of the responsible HAZCOM person.
- b) Provide the names for the person responsible for updating the Material Safety Data Sheets (MSDS).
- c) Provide the names for the person responsible for "Labeling" Hazardous Materials".
- d) Provide the names for the person responsible for "Training employees".

- e) Provide the names for the person responsible for “contingency Plan”.
- f) Provide the names for the person who will disseminate information to the FAA within 24 hours.
- g) Identify workers who are trained in HAZCOM.
- h) Identify workers who are trained HAZMAT.
- i) Provide Material Safety Data Sheets (MSDS) for all chemicals to be brought on site including those used in construction equipment (e.g. hydraulic fluid, transmission oil, etc.)
- j) Identify where the MSDS’s will be kept.
- k) Identify if the labeling requirements to be used are documented.
- l) The procedure to be used to introduce unanticipated chemical at the job site.
- m) Identify the established communications method to be used between contractor and the subcontractor. (E.g. precon, tailgate, or safety committee meetings).
- n) If facility air monitoring to be conducted on a continuous basis.
- o) If facility air monitoring been conducted in the project area.
- p) If personnel monitoring to be conducted.
- q) If personnel monitoring to be conducted on a continuous basis.
- r) Measures to be used to reduce exposure risk to workers and building occupants (e.g. PPE, additional ventilation, temporary structures, signs, and others).

**1-10.3.3 Lead Related Work:** All lead related work including inspections (lead sampling), risk assessment, and abatement/mitigation shall be performed in compliance with California Occupational Safety and Health Administration’s (Cal/OSHA’s) Lead in Construction Standard, Title 8, California Code of Regulations, Section 1532.1. An approved standard operational procedure (SOP) may be submitted for approval and used to perform lead related work. The Contractor may submit for approval the proposed SOP to the Contracting Officer with sufficient documentation (including lead sampling results and negative air assessments) to support and document the safety of the method. All work shall be performed with minimum risk to employees and building occupants. No finished walls, ceilings, or floors shall be drilled or core drilled without first having been sampled and tested for lead content. Lead related work shall be defined as those activities which impact lead containing coatings (LCC) or any finished surface containing lead. Personal air monitoring samples shall be collected during the performance of all lead related work. Respiratory protection equipment will not be required for the performance of lead related work if an acceptable SOP has been submitted and approved with acceptable and documented negative exposure assessment data.

**1-10.3.3.1 Personal Air Sampling:** Personal air monitoring samples shall be collected during the performance of all lead related work. Samples shall be collected using low volume (low flow) air monitoring pumps (calibrated at 0.5 to 2.5 liters per minute flow rate) to determine worker exposures for given activities over a certain period of time; all samples shall be ultimately calculated as an eight hour TWA. Samples shall be collected using 37 mm cassettes (closed face) with 0.8  $\mu$ m cellulose ester membrane, using the appropriate National Institute Occupational Safety and Health (NIOSH) Method.

**1-10.3.3.2 Lead Exposure Limits:** Adherence to the following current OSHA exposure limits, for personal sampling is required:

	<u>Lead Exposure Limit</u>	<u>Work Period</u>
Action Level (AL) (TWA)	30 $\mu\text{g}/\text{m}^3$	8 hours
Permissible Exposure Limit (PEL) (TWA)	50 $\mu\text{g}/\text{m}^3$	8 hours

**1-10.4 Contractor's Responsibility:** The Contractor shall not permit any employee to work in surrounding or under working conditions which are unsanitary, hazardous, or dangerous to the health and safety of the employee.

**1-10.5 Accident Prevention:** The Contractor shall bear the responsibility of maintaining an accident prevention program such that the frequent and regular inspections of the job site, materials and equipment are made by a competent person designated by the employer.

**1-10.6 Use of Equipment:** The use of any machinery, tool, material, or equipment shall comply with OSHA regulations. The employer shall permit only those employees qualified by training or experience to operate equipment and machinery.

**1-10.7 SubPart E (Worker Protection):** The Contractor shall provide adequate protection for the head, ears and eyes for all employees working in an area where hazards to such exist. Consult Subpart E of OSHA 29 CFR 1926 for complete requirements.

**1-10.8 Subpart I (Tools):** All hand tools and power tools and similar equipment whether furnished by the Contractor or the employee shall be maintained in a safe condition. The use of such tools shall be limited to the intended use of said tools. Consult Subpart I of OSHA CFR 1926 for additional requirements.

**1-10.9 Subpart K (Electrical):** The Contractor shall furnish ground Fault Protection for all electrical equipment used on the jobsite. Installation of the facilities will require energizing numerous circuits. The Contractor shall protect against electrical shock by methods such as posting warning signs, supplying insulated gloves, locking out and tagging de-energized circuits and other similar methods. Consult Subpart K of OSHA CFR 1926 for additional requirements.

**1-10.10 Subpart P (Earthwork):**

- Prior to commencing trenching or excavation, the Contractor shall ascertain that the area has been inspected for all utility lines and has been adequately marked.
- The side slopes of trenches and excavations shall not exceed the angle of repose of the soil unless bracing is installed. All trenches and excavations shall be regularly checked for stability. In case of a rain shower, the Contractor shall suspend work activity within

the trench or excavation until the stability of the trench or excavation is ascertained.  
Consult Subpart P of OSHA CFR 1926 for additional requirements.

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## **DIVISION 1- GENERAL REQUIREMENTS**

### **SECTION 1-12**

#### **CONSTRUCTION SCHEDULE**

**1-12.1 General:** This section describes the requirements for demolition and construction scheduling for this project.

**1-12.2. Applicable Documents:** None

**1-12.3 Progress Chart:** The Contractor shall formulate a Construction Schedule (Progress Chart) to meet the FAA requirements set forth in section 1-12.4. The schedule shall show the order in which the contractor proposes to carry out the work, the dates on which the contractor will start the several salient features of the work (including procurement of materials), dates for completing those features. The progress schedule submitted shall be consistent in all aspects with the time and order of work requirements of the contract.

At the minimum, the progress chart shall be a simple bar chart on 8 1/2" x 11" bonded paper. The Progress Chart shall be submitted to the Contracting Officer within 10 calendar days after the notice of award. The Contractor shall provide a minimum of 6 copies of the Progress Chart.

**1-12.3.1 Preliminary Review.-** The Progress Chart will be given a preliminary review by the FAA prior to a final review and analysis prior to the Preconstruction Conference. The Contractor shall participate in the review and evaluation process. Any revisions necessary as a result of this review shall be resubmitted within 5 days after the review conference. The schedule shall then be the schedule to be used by the Contractor for planning, organizing and directing the work, and reporting progress. The Contractor shall provide 6 copies of the approved schedule to the Contracting Officer on legible computer printout.

If the Contractor thereafter desires to make changes in the schedule he shall notify the Contracting Officer in writing stating the reasons for the change. If the Contracting Officer considers these changes to be of a major nature he may require the Contractor to revise and submit for approval, without additional cost to the Government, all of the affected portion of the diagrams and mathematical analysis to show the effect on the entire project. A change may be considered of a major nature if the time estimated to be required or actually used for an activity or the logic of sequence of activities is varied from the original plan to a degree that there is a reasonable doubt as to the effect on the contract completion date or dates. Changes which affect activities with adequate slack time shall be considered as minor changes, except that an accumulation of minor changes may be considered a major change when their cumulative effective might affect the contract completion date.

1-12.3.2 Supplement Schedule: As the work progresses and upon written request by the COTR, the contractor shall submit within two (2) working days of the date of the written request, a supplementary schedule consistent with the actual progress of the work.

1-12.3.3 Schedule Change: If any change in the approved progress schedule is to be made or becomes necessary due to unforeseen circumstances, the contractor shall notify the COTR immediately in writing and may, upon approval by the COTR, change the order of work and /or schedule of operations. A revised schedule shall be submitted to the COTR within 3 working days.

**1-12.4. FAA Scheduling Requirements:**

1-12.4.1 Performance Period: All contractual work shall be completed within 30 calendar days.

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## **DIVISION 2- SITE WORK**

### **SECTION 2-1**

#### **PRECAUTIONS FOR EXISTING UNDERGROUND UTILITIES**

**2-1.1 General:** This section covers the precautions that the contractor must take to prevent damage of existing underground utilities.

#### **2-1.2 Existing Underground Utilities:**

**2-1.2.1 Location of Utilities:** It shall be the contractor's responsibility to locate all underground utilities in the area where excavation activity will take place. The Contractor shall survey the site to identify and locate all underground utilities including nonmetallic pipes and cables. Underground utilities are indicated either on the project plans or on the reference drawings. The FAA does not guarantee the accuracy or the completeness of the information. Any inaccuracy or omission of such information shall not relieve the Contractor of his responsibility to locate the underground utilities.

**2-1.2.2 Notification of Utility Owners:** The Contractor shall notify the Owners of all utility services in the area of the contract work by calling "Arizona Blue Stake" at 811 when calling in Arizona. They can also be reached at website: [WWW.Azbluestake.com](http://WWW.Azbluestake.com).

Before making the notification, the Contractor shall mark each trench path so that the route can be visually seen. The contractor should request that each party mark the location where their underground utilities cross the trench route.

**2-1.2.5 Working Around Underground Utilities:** When underground utility have been located and staked on the ground, the contractor shall use a hand excavation method to expose the lines. Once the underground utility lines have been exposed, the contractor shall take the necessary precautions to ensure that they are not damaged.

Should the contractor damage or interrupt the operation of a utility service or facility by accident or otherwise, he shall immediately notify the proper authority and shall take all reasonable measures to prevent further damage or interruption of service. The Contractor, in such events, shall cooperate with the utility service or facility Owner until such damage has been repaired and service restored to the satisfaction of the facility owner. The facility owner shall have the option of either repairing the damaged cable(s) using his own work force or have the contractor repair the cable(s). In any event, the contractor will be responsible for all cost associated with repairs and the restoration of service to the facility.

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## **DIVISION 2- SITE WORK**

### **SECTION 2-2**

#### **EXCAVATION, FILLS AND BACKFILLS**

**2-2.1 General:** This section covers site work consisting of grubbing, scarifying, excavating, trenching, cable and duct installation, backfilling, compacting, soil stabilization, grading, and clean up.

#### **2-2.2 Applicable Documents:**

2-2.2.1: The following publications, issue in effect on the date of this solicitation, form a part of this specification.

##### 2-2.2.1.1 FAA Specification:

FAA-C-1391b Installation and Splicing of Underground Cables

2-2.2.1.2: Additional ASTM standards and specifications also apply to this project:

D-1556	Density of Soil in Place by the Sand-Cone Method
D-1557	Moisture-Density Relations of Soils
D-2922	Nuclear-Density of Soil and Soil-Aggregate in Place by Nuclear Methods

#### **2-2.3 Materials:**

All equipment and materials covered by referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification.

2-2.3.1 Site Materials: Unless noted otherwise aggregate base for backfill material shall be  $\frac{3}{4}$ " aggregate class II road base.

2-2.3.2 Local and Import Fill: All fill material shall be free from organic matter, debris, vegetation and other deleterious substances. It shall be of a quality suitable for the purpose intended and shall compact thoroughly without the presence of excessive voids when watered and compacted.

2-2.3.3 Soil Sterilization: Soil sterilizing agent shall be non-selective in action and toxic to all types of vegetation, offering extended residual control. Care must be taken to confine the use or application to the particular area intended to be treated. Do not drain or flush equipment near other areas. Avoid contamination of domestic or irrigation water. Consult State Agriculture Experiment Station or Extension Service Weed Specialists for specific requirements for local weed problems. Soil sterilization agent shall be Dupont "Hyvar X-L" by Dupont Corp; "Weed-Free G", Chapman Chemical, Memphis,

Tennessee; "Chlorea Granular", Rhone-Pouleng, Inc., Manmouth Junction, New Jersey, or an approved equal.

## **2-2.4 Excavation/Trenching:**

2-2.4.1 Existing Underground Utilities: Refer to section 2-1 of the project specifications.

2-2.4.2 Clearing and Grubbing: Before beginning excavation or grading operations in any area, the area shall be completely cleared and grubbed. Clearing and grubbing shall consist of clearing the surface of the ground of the project site of all trees, snags, brush, undergrowth, hedges, heavy growth of grass or weeds, fences, debris, and rubbish of any nature, natural obstructions or such material which in the opinion of the FAA COTR is unsuitable. The grubbing of stumps and roots will not be required. Clearing and grubbing includes the disposal of waste materials and spoil materials resulting from the operation.

All holes, ruts, and potholes remaining after the grubbing operation shall be filled with acceptable material, moistened and properly compacted in layers to the density indicated the section 2-2. The same construction procedure shall be applied to all holes remaining after grubbing in excavation areas where the depth of holes exceeds the depth of the proposed excavation.

2-2.4.3 Excavation/Trenching: Excavation/Trenching is required for the installation of cables, conduits, pullboxes, & concrete foundations as shown on the project drawings. Excavation activity shall only be permitted on the days between Monday through Thursday. No excavation activity shall take place on Fridays and on weekends.

2-2.4.3.1 Archaeological Artifacts: During excavation or at any other time that evidence of any archaeological artifacts, human burial remains, or unique paleontology if found, the contractor shall immediately notify the COTR and cease work.

The contractor shall grant the FAA seventy-two hours (72) hours to evaluate the archaeological evidence. The contractor will be granted an extension of time and will not be assess with liquidated damages or any other penalties for the 72-hour period. The contractor shall have no claim for any additional damage or compensation due to this delay.

For additional time beyond the 72-hour period, required by the FAA to pursue any action relative to the archaeological aspects of the site, the contractor will be granted an appropriate time extension and/or receive additional compensation.

The contractor shall not resume work in the area until the COTR gives written approval.

2-2.4.4 Excavated Material: In the event excavated material is not suitable or sufficient amounts are not available to meet the grade requirements of the site, the Contractor shall make his own arrangements to provide for off site sources. The material shall be subject to the RE's approval and shall be supplied at no additional cost to the Government.

Excess excavated soil, if any, shall be disposed of off the project site at a location selected and arranged for by the Contractor and in accordance with local ordinances.

2-2.4.5 Excavation Depth: Excavation shall be carried to the depth required for footings and slabs, and shall be of the size required for the work, including space required for forms and bracing.

2-2.4.6 Form Excavation: Excavation for concrete footings and site areas shall be finished to reasonably smooth and uniform surfaces. Where the ground in which excavation being performed is sufficiently stable to be self-supporting for the depth of excavation required, it may be trimmed to the finish lines of footings plus 2 inches in lieu of using forms for placing concrete.

2-2.4.7 Over Excavation: Where excavation for footings and foundations is carried to a depth greater than is required, backfilling with earth will not be permitted. In such instances, backfilling shall be done with concrete at no additional cost to the Government.

2-2.4.8 Wet Excavation: No additional compensation will be allowed for any sheeting, shoring, pumping, or draining required to place and keep excavations in dry condition for construction. No water shall be allowed to remain in or around any part of the work.

2-2.4.8 Excavations: Where turf is well established and sod can be removed, it shall be carefully stripped and properly stored.

2-2.4.9 Rock: Where rock is encountered, it shall be removed to a depth of 3 inches below the required cable depth, and shall be replaced with a bedding material of earth or sand containing no mineral aggregate particles that would be retained on a 1/4-inch sieve.

## **2-2.5 Duct Installation:**

2-2.5 General: The Contractor shall install underground ducts at the approximate locations indicated on the plans. The COTR shall indicate specific locations as the work progresses. Ducts shall be of the size, material, and type indicated in the plans or specifications. Where no size is indicated in the plans or specifications, the ducts shall be not less than 3 inches (50 mm) inside diameter.

2-2.5.2 Cable Location And Depth Requirements: Unless indicated otherwise all cables, ducts, and conduits shall be installed as follows:

(a) A minimum of 24" below grade.

(b) Underground ducts shall be installed so that the tops of all such ducts are at least 24 inches below finished grade. Underground ducts, except rigid steel conduit, shall not be installed under paved areas, roadways, railroad tracks, or ditches.

(c) Concrete-encased duct or rigid steel conduit shall be installed so that the top of the concrete envelope or conduit is not less than 18 inches below the bottom of paving when installed under runways, taxiways, and other paved areas; and not less than 24 inches below finished grade when installed in unpaved areas.

(d) When cable is routed under railroad tracks, it shall be in rigid-steel conduit or concrete-encased duct with the top of the duct not less than 42 inches below the base of the rail.

(e) Control and signal cables may be installed without separation from each other.

(f) Unless otherwise specified, all cables in the same location and running in the same general direction shall be installed in the same trench. Trenches for cables may be excavated manually or with powered trenching equipment. Walls of trenches shall be essentially vertical so that a minimum of shoulder surface is disturbed. The bottom surface of trenches shall be essentially smooth and free from coarse aggregate. Unless otherwise specified, trenches shall be opened only for the time required to install and inspect cables. The trench shall be closed in the same working day.

#### 2-2.5.3 Separation of Cables Installed in Conduit or Duct:

Unless indicated otherwise all cables, ducts, and conduits shall be installed as follows:

(a) Power cables of the same circuit shall be installed in the same duct.

(b) Power cables of less than 600 volts for different circuit may be installed in the same duct.

(c) Power cables shall not be installed in the same duct with control and signal cables.

(d) Power cables shall not be installed in the same duct with power cables of a lower voltage rating.

(e) Control and signal cables may be installed in the same duct.

(f) Power cables may be installed in the same duct system as control and signal cables, but power cable shall be installed in a different duct separated a minimum of 6 inches (outside wall to outside wall) from ducts that encase control and signal cables. Power cables rated more than 600 volts shall be separated from control and signal cables to the maximum extent possible in the duct system or as indicated on the plans.

2-2.5.4 Installation: Standard precast spacers shall be used for duct support and alignment. Where no size is indicated on the drawings, the ducts shall not be less than 4 inches inside diameter. All duct lines shall be laid to slope toward handholes, manholes, and duct ends for drainage. Grades shall be at least 3 inches per 100 feet. On runs where it is not practicable to maintain the slope all one way, the duct line shall be sloped from

the center in both directions toward manholes, handholes or duct ends. Pockets or traps where moisture may accumulate shall be avoided.

2-2.5.5 Access penetrations: Where a steel conduit penetrates a wall of a manhole or handhole, a grounding bushing shall be provided. These grounding bushings shall be connected to each other and to the earth grounding system with a No. 6 AWG bare copper conductors.

2-2.5.6 Pull rope: All ducts installed shall be provided with a No. 10 gauge galvanized iron or steel drag wire or nylon pull rope for pulling the permanent wiring. Sufficient length shall be left in manholes or handholes to bend the drag wire back to prevent it from slipping back into the duct.

2-2.5.7 Spare ducts: (1) All spare ducts installed by the Contractor shall be provided with No. 10 AWG copper-clad steel pull wires or nylon pull rope with a minimum tensile strength of 200 pounds; (2) the open ends shall be plugged with removable tapered plugs, designed by the duct manufacturers, or with hardwood plugs conforming accurately to the shape of the duct and having the larger end of the plug at least 1/4inch (6 mm) greater in diameter than the duct.

2-2.5.8 Mandrel Requirements: The Contractor shall mandrel each duct he installs and each existing duct in which he installs or replaces cable. An iron-shod mandrel, not more than 1/4-inch smaller than the bore of the duct, shall be pushed through each duct with jointed conduit rods. The mandrel shall have a leather or rubber gasket slightly larger than the duct hole.

2-2.5.9 Duct Protection: All ducts shall be securely fastened in place during construction and progress of the work, and shall be plugged to prevent seepage of grout, water, or dirt. Any duct section having a defective joint shall not be installed.

2-2.5.10 Ducts Encased in Concrete:

- Unless otherwise shown in the Plans, all ducts installed under pavement shall be concrete encased. Concrete-encased ducts shall be installed so that the top of the concrete envelope is not less than 4 inches (15 cm) below the finished subgrade where installed under runways, taxiways, aprons, or other paved areas, and not less than 24 inches (60 cm) below finished grade where installed in unpaved areas.
- Trenches for concrete-encased ducts shall be opened the complete length before concrete is laid so that if any obstructions are encountered, proper provisions can be made to avoid them.
- All ducts for concrete encasements not in paved areas shall be placed on a layer of concrete not less than 2 inches thick prior to its initial set. Where two or more ducts are encased in concrete, the Contractor shall space them not less than 2 inches apart (measured from outside wall to outside wall) using spacers applicable to the type of

duct. As the duct laying progresses, concrete not less than 2 inches thick shall be placed around the sides and top of the duct bank. End bells or couplings shall be installed flush with the concrete encasement where required.

2-2.5.11 Ducts Without Concrete Encasement: Trenches for single-duct lines shall be not less than 6 inches nor more than 12 inches wide, and the trench for two or more ducts installed at the same level shall be proportionally wider. Trench bottoms for ducts with concrete encasement shall be made to conform accurately to grade to provide uniform support for the duct along its entire length. A 3-inch layer of bedding material shall be placed around the ducts. The bedding material shall contain no particles that would be retained on a 1-inch sieve. The bedding material shall be tamped until firm. When two or more ducts are installed in the same trench with concrete encasement, they shall be spaced not less than 2 inches apart (outside wall to outside wall) in a horizontal direction or not less than six inches apart (outside wall to outside wall) in a vertical direction.

2-2.5.12 Guard Cables: Bare stranded #/0 copper guard cable is required above all duckbanks. The guard cable shall be installed 12" above and parallel to the cable or duckbank being protected. The guard cable shall be connected to the Earth Electrode System (EES) at each end of the run. Refer to section 16-2.

2-2.5.13 Warning Tape: A plastic red warning tape, Brady "Identoline" or similar, shall be continuously imprinted with the appropriate legend and shall be located six (6) inches below finished grade and directly above the conduit or duckbank.

## **2-2.6 Backfilling:**

2-2.6.1 General: Trenches shall not be excessively wet and shall not contain pools of water during backfilling operations. Trenches shall be completely backfilled and tamped level with the adjacent surface. If necessary to obtain the desired compaction, backfill material shall be moistened or aerated. When sod is to be placed over a trench, backfill shall be stopped at a depth equal to the thickness of the sod to be used. Any excess excavated material shall be removed in accordance with instructions from the COTR.

2-2.6.2 Underground Cable: After underground cable has been installed the trench shall be backfilled. The first layer of backfill shall be 3 inches deep, loose measurement, and shall be either earth or natural sand containing no material aggregate particles that would be retained on a 1/4-inch sieve. This layer shall not be compacted. The second layer shall be 9 inches deep, loose measurement, and shall contain no particles that would remain on a 1-inch sieve, the remainder of the backfill shall be excavated or imported material and shall not contain stone aggregate larger than 4 inches maximum diameter. The second and subsequent layers shall be thoroughly tamped and compacted to at least the density of the adjacent undisturbed soil and to the satisfaction of the COTR.

2-2.6.3 Compaction: Compaction shall include watering, drying, blading, tamping, rolling and/or such other operations required to produce the densities specified herein. Densities specified shall be the minimum acceptable and shall be expressed in

percentage, as the ratio of 'field' density to 'maximum' (laboratory) density. 'Field' density shall be that value obtained on the compacted material in place, and 'maximum' shall be the value obtained on a representative sample tested in the laboratory (maximum density being the maximum obtained at optimum water content in the laboratory; this density being 100%). "Density" in this specification shall mean the maximum obtained in the laboratory. Testing shall be performed in accordance with standards listed in Section 2-2.2.1.2.

2-2.6.4 Restoration: Where sod has been removed it shall be replaced as soon as possible after the backfilling is completed. All areas disturbed by the trenching, storing of dirt, cable laying, pad construction, and other work shall be restored to the original condition. Restoration shall include any necessary grading, fertilizing, liming, seeding, sodding, sprigging or mulching as required to restore the disturbed area to match the adjacent area. Where trenching cuts through paved areas, the surface shall be properly backfilled and resurfaced with paving similar to the original paving. Resurfaced areas shall be level with original paving, free from cracks and capable of withstanding full traffic loads without settling or cracking. The Contractor shall be held responsible for maintaining all disturbed and restored surfaces until final acceptance.

2-2.6.5 Foundation Backfill: After foundations have been constructed and have reached adequate set, trenches and excavations shall be backfilled. Backfill shall be placed on both sides of foundations at the same time, and both sides tamped prior to placing of the next layer of material. Special care shall be taken to prevent any uneven wedging action against the structure. The COTR shall inspect all installations prior to placement of backfill. Placement of backfill shall be in 6 inch layers.

2-2.6.6 Aggregate Base: The Contractor shall furnish and place the aggregate base in locations and depths as shown on the plans. Finished surfacing shall be neatly shaped and graded.

2-2.6.7 Soil Sterilization: Areas to be graveled shall be treated with a soil sterilization agent. Apply sterilant after the surfacing has been spread, shaped, and rolled. Apply according to manufacturer's directions.

2-2.6.8 Excess Excavated Materials: Any excess excavated material shall be removed and disposed of off airport

2-2.6.9 Concrete-Encased Ducts Not In Pavement: After concrete-encased ducts, not installed in pavement, have been properly installed and the concrete has had time to set, the trench shall be backfilled, in at least two layers, with excavated material not larger than 4 inches (100 mm) in diameter, and thoroughly tamped and compacted to 90% relative density or at least the density of the surrounding undisturbed soil, whichever is greater. If necessary, to obtain the desired compaction, the backfill material shall be moistened or aerated as required.

2-2.6.10 Restoration: All areas disturbed by the trenching, storing of dirt, cable laying, pad construction and other work shall be restored to its original condition. The restoration shall include any necessary topsoiling, fertilizing, liming, seeding, sprigging, or mulching. The Contractor shall be held responsible for maintaining all disturbed surfaces and replacements until final acceptance.

## **2-2.9 Quality Assurance:**

2-2.9.1 Compaction Test: The Government will perform at its own expense all initial compaction tests deemed necessary. Material tested that does not meet specifications shall be re-compacted or if necessary, shall be replaced, compacted and retested at the Contractor's expense.

2-2.9.2 Compaction Density Requirements: The various areas of compaction and interval testing shall be as follows:

- Fill embankments shall be 95% density with one (1) test per lift.
- Road subgrade and gravel surfacing shall be 95% density with one (1) test per 400 LF or fraction thereof.
- Fill material under slabs and other concrete pads shall be 95% density with one (1) test per structure.
- Fill materials used for trenches under roadways shall be 95% density with one (1) test per 100 LF or fraction thereof.
- Fill materials under runways, runway-overflow areas, and taxiways shall be 100% density with one (1) test per 100 LF or fraction thereof.
- Other trench areas and walkways shall be 90% density with one (1) test per 400 LF or fraction thereof.

2-2.9.3 Trench and Excavation Inspections: When excavations are completed, notify the COTR for his inspection and approval prior to placement of concrete or installation of cables, ducts or piping.

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**DIVISION 2- SITE WORK**  
**SECTION 2-3**  
**ASPHALT SURFACE REPAIR**

**2-3.1. General Summary**

- This section includes repair of roadway asphalt pavement surfaces cut and removed for the demolition of buried utility services below roadbed.
- This section includes the repair of asphalt surfaces weakened or damaged due to mechanical demolition equipment or dump truck traffic.
- The limits of such repairs shall be the vicinity of the existing demolition project site, contractors parking and storage areas, the roadways access routes utilized by the contractor, and the access routes outside of the facility leading to a public roadway.
- The contractor shall photograph and document the pre-construction conditions of the access road routes from the project site to the public road.

**2-3.2 Materials**

- a. Base Course: Base course shall be native material free of organic matter and trash.
- b. Asphalt Concrete: Asphalt concrete shall be Class D1-AR4000.

**2-3.3 Execution**

- a. Surface restoration type: type and details of surface restoration shall be as shown on the drawings or as specified. Where not shown or specified, surface shall be restored with the type that matches the existing surfaces or that is the most appropriate for adjacent surfaces.

**b. Asphalt Concrete Pavement Replacement**

- a. Subgrade: The subgrade shall be compacted to 95% relative compaction.
- b. Base Course
  - The base course thickness shall match or exceed the adjacent existing base course thickness.
  - Edges of existing pavement that are damaged or broken shall be trimmed to a straight line. Trimming shall provide a smooth, sound, vertical edge for the new pavement to join.
- c. Asphalt Concrete

- Asphalt concrete for surface restoration shall be placed in accordance with Standard Specifications for Public Works Construction (SSPWC) Sections 302-5.5 through 302-5.7 and as specified.
- On prepared base course or existing pavement, the depth of asphalt concrete shall be the depth of the adjacent existing pavement plus 1 inch, but not less than 2 inches.
- Asphalt paving may be placed in a single lift, providing the required thickness is not greater than 3 inches. Where the thickness is greater than 3 inches, the surfacing shall be placed in 2 or more lifts. Each lift shall be 3 inches maximum.
- Asphalt concrete shall be spread and leveled by machine if possible. Hand tools or a mechanical spreader may be used only if the area is too confined for machine spreading.

d. Compaction

- Compaction shall be performed with powered rollers capable of providing compression of 200 to 300 pounds per linear inch of roller.
- Rolling shall begin from the outside edge of the pavement replacement and shall progress towards the existing surfacing. The rolling shall lap the existing surface by at least half the width of the roller.
- Where the existing surfacing bounds both edges of the pavement replacement, rolling shall begin at the edges of the replacement, lapping the existing surface at least half the width of the roller, and shall progress towards the center of the replacement area. Each track shall overlap the preceding track by at least half the width of the roller, and sufficient passes shall be made over the entire area to produce the required compaction and to remove roller marks.
- Hand tampers shall be used where rolling is impossible or impractical.
- The finished surface of the new compacted paving shall be flush with the existing surface and shall conform with the grade and crown of the adjacent pavement.

#### 2-3.4 Field Quality Control

The Engineer will determine when atmospheric conditions, surface conditions, and material conditions are appropriate to proceed with surface restoration construction.

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## **DIVISION 3-CONCRETE**

### **SECTION 3-1**

#### **CONCRETE FORMWORK**

**3-1.1 GENERAL:** This section covers the minimum requirements for concrete formwork.

**3-1.2 APPLICABLE DOCUMENTS:** The current issues of the following documents in effect on the date of the invitation for bid form a part of this specification and are applicable to the extent specified herein.

**3-1.2.1 American Concrete Institute (ACI) Publications:**

347	Recommended Practice for Concrete Formwork Chapters 1, 2
SP4	Formwork for Concrete, Chapter 6, 7

**3-1.2.2 American Society for Testing and Materials (ASTM):**

A307	Low Carbon Steel Externally and Internally Threaded Standard Fasteners
D1752	Specification for Pre-formed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
A-153	Specifications for Zinc Coating (Hot-Dip) on iron and Steel Hardware

**3-1.2.3 U.S. Department of Commerce, National Bureau of Standards:**

PS1-66	Softwood Plywood - Construction and Industrial
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**3-1.3 MATERIALS:**

**3-1.3.1 Form Framing:** Southern Yellow Pine or Douglas Fir construction grade or better, dressed or rough.

**3-1.3.2 Form Sheathing:**

**3-1.3.2.1 Boards:** Southern Yellow Pine or Douglas Fir construction grade or better, S4S 1 x 6 boards. Use center matched boards where forms are unlined and concrete will be visible.

3-1.3.2.2 Plywood: Plywood shall comply with U.S. Products PS1-66 and bear grade trademark of the American Plywood Association. B-B Plyform Class 1 exterior, 5/8 inch thick minimum.

3-1.3.3 Fiber/Laminated Paper Tubes: Form tube supplier shall be regularly engaged in the manufacturing and sale of fiber/laminated paper tube forms. Suppliers that are acceptable include but is limited to SONOCO Products Co. and Jefferson Smurfit Corp.

3-1.3.4 Accessories: Spreaders, etc., of required type, size and finish.

3-1.3.5 Form Coating: Non-staining chemical compound compatible with the direct applied coating required on concrete. Crete-Lease 770 or approved equal.

3-1.3.6 Anchor Bolts and Plates: As shown on the project drawings. Where not shown use carbon steel: ASTM A307 Grade B, hot-dip galvanized per ASTM A-153.

3-1.3.7 Compressible Filler: Cork, ASTM D1752, Type II

### **3-1.4 INSTALLATION:**

#### **3-1.4.1 Relation With Other Trades:**

3-1.4.1.1 General: Inserts, anchors, sleeves, bolts, plates, and similar items required by other trades to be cast in concrete work shall be furnished and located by each such trade. Build such items into forms in a manner that will prevent displacement or damage to them during placing of concrete. Verify sizes and locations. Contractor shall be responsible for inspecting all construction documents to ensure the proper installation of all embedded items and provisions of openings. Provide pads required for exterior equipment as shown.

3-1.4.1.2 Location of Foundations: The project drawings indicate the approximate location. The COTR shall determine the exact location.

#### **3-1.4.2 Forms for Structural Concrete:**

##### **3-1.4.2.1 Tolerances:**

3-1.4.2.1.1 General: Unless otherwise specified, shown, or required to accommodate abutting or adjacent materials, tolerances for formed surfaces shall conform to ACI 301 Table 4.3.1 which shall be considered maximum and shall be reduced as necessary to conform to details and to permit the proper installation of adjacent and abutting materials.

3-1.4.2.1.2 Correction: Correct work outside of required tolerances as directed without limit to extent of work required.

3-1.4.2.2 Support of Forms: The total responsibility for the proper and adequate design, construction, support and bracing of forms to provide the required concrete sections and to support, without deflection, the wet concrete and other construction loads imposed on them rests entirely with the Contractor. The requirements of this Specification are to be considered as minimum only. Re-brace, tighten, etc., any displaced forms as necessary to bring them back to required line and level.

3-1.4.3 Unlined Wood Forms: Contact surface shall be free of warpage, cupping and large or loose knots. Break joints and double nail.

3-1.4.4 Slabs/Antenna Pads and Foundations: Set the tops of edge forms to the required grade. For slabs on grade, also place stakes at sufficient intervals and driven so that the top of the stake is at the required elevation, to provide adequate guides for the screed operation. Provide adequate screeds to permit finishing slabs within the required tolerances. Provide a broom finish for Antenna pads and foundations. Where the slab surface is required to slope for drainage, unless shown otherwise, slope exterior slab surfaces 1 inch in 4 feet. Remove edge form and stakes prior to backfill.

3-1.4.5 Ties and Spreaders: Lengths shall be as required to provide proper concrete thickness. When practical, locate and space ties and spreaders symmetrically at approximately 3 foot centers both ways, in plumb tiers and level rows.

3-1.4.6 Expansion Joints: As specified on the plans

3-1.4.7 Contraction Joint: As specified on the plans.

3-1.4.8 Construction Joint:

3-1.4.8.1 General: Place compressible filler strip of required thickness, full width of the concrete section. Secure the strip against displacement during pour. Top of strip shall be parallel with the concrete surface and flush with it unless a recess for application of sealant is required. Form such recesses with removable temporary strips.

3-1.4.9 Form Coating: Coat the inside of forms in accordance with coating manufacturer's printed installation instructions.

3-1.4.10 Checking Forms: As concrete is placed, make frequent checks on forms to detect any change in position. Replace, tighten, etc., any displaced forms as necessary to bring them back to required line and level.

3-1.4.11 Equipment Pads: Provide unlined forms for pads or slabs required for mechanical and electrical equipment.

### **3-1.5 QUALITY ASSURANCE:**

3-1.5.1 Construction of Forms: Locate and construct forms accurately so that finished concrete will conform to shapes, lines, grades and dimensions shown on the drawings. Joints shall be vertical unless otherwise specified, and sufficiently tight to prevent leakage.

3-1.5.2 Size of Forms: Size forms so that all reinforcing, ties, etc., shall have the minimum coverage required in the structural general notes on the drawings. Thickness of concrete coverage shall be measured from face of vertical or horizontal bars and face of stirrups in beams. Coverage not indicated shall conform to ACI 318.

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## **DIVISION 3-CONCRETE**

### **SECTION 3-2**

#### **CONCRETE REINFORCEMENT**

**3-2.1 GENERAL:** This section covers the minimum requirements for steel reinforcement.

**3-2.2 APPLICABLE DOCUMENTS:** The following specifications and standards of the issues currently in force form a part of this section.

**3-2.2.1 Federal Specifications:**

QQ-W-461      Wire, Steel, Carbon (Round, Bare and Coated)

**3-2.2.2 American Society for Testing and Materials (ASTM) Publications:**

A185              Welded Steel Wire Fabric for Concrete  
A615              Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

**3-2.2.3 American Concrete Institute (ACI):**

318                Building Code Requirements for Reinforced Concrete

**3-2.2.4 Concrete Reinforcing Steel Institute (CRSI):**

Manual of Standard Practice and Recommended Practice for Placing Reinforcing Bars

#### **3-2.3 MATERIALS:**

**3-2.3.1 General:** All of the following materials shall be produced and fabricated in the U.S.A.

**3-2.3.2 Reinforcing Steel:** Carrying rolled-on identifying marks to denote the mill location, bar size and type of steel. Grade 60 shall also be marked to indicate minimum yield.

**3-2.3.2.1 Deformed Billet Steel:** ASTM A615 of the grades shown on the drawings and specified. Where not indicated Grade 60 bars shall be provided.

**3-2.3.3 Welded Wire Fabric:** ASTM A185 cold drawn steel welded wire fabric. See drawings for size of wires and mesh.

**3-2.3.4 Dowels:** Conform to Paragraph 3-2.3.2

**3-2.3.5 Stirrups and Ties:** Conform to Paragraph 3-2.3.2

3-2.3.6 Accessories: Provide spacers, chairs, wire ties, etc., necessary to properly assemble, space and support the reinforcing in place during placement of concrete, as recommended by the Concrete Reinforcing Steel Institute. Accessories shall be sized to provide required concrete coverage. Position and support bolts, anchors, and other cast-in items with appropriate accessories. Spacers, chairs, wire ties, etc., fabricated of standard bright basic wire. Chairs placed on porous fill shall have 3 x 3 inch 16 gage steel base pads or plates to prevent them from penetrating the supporting surface.

3-2.3.7 Tie Wire:

3-2.3.7.1 For Reinforcing Steel: Federal Specification QQ-W-461, 16 gage minimum annealed black steel.

**3-2.4. INSTALLATION:**

3-2.4.1 Extent of Work: Provide reinforcing for all concrete unless it is definitely specified or noted to be plain or un-reinforced.

3-2.4.2 Spacing Limits/Protection: The spacing limits and minimum concrete protection shall meet the minimum requirements of ACI 318.

3-2.4.3 Placement Tolerance:

Concrete cover to form surfaces: Plus or minus 1/4 inch.

Minimum spacing between bars: 1/4 inch.

Top bars in slabs: 1/4 inch.

Members 8 inches or less deep: Plus or minus 1/4 inch.

Crosswise of members: Space evenly within 2 inches of stated separation.

Lengthwise of members: Plus or minus 2 inches.

Maximum bar movement to avoid interference with other reinforcing steel, conduit or other embedded work: 1 bar diameter.

3-2.4.4 Fabrication of Reinforcing Bars:

3-2.4.4.1 Material: Use deformed bars unless otherwise specified or shown.

3-2.4.4.2 Forming: Unless noted otherwise, bend bars cold. Do not straighten or re-bend without specific approval from COR. Torch cutting at the job will not be permitted without prior approval of the COR.

3-2.4.4.3 Joints:

Expansion joints – As specified on the plans.

Construction joints– As specified on the plans.

3-2.4.4.4 Laps and Splices: Use a minimum number of splices. Lap splices in strict accord with ACI 318 or as shown. Do not make splices at points of maximum stress. Stagger splices in adjacent bars.

3-2.4.5 Cleaning: Remove from reinforcing scale, heavy rust, and any coating which would reduce bond.

3-2.4.6 Placement:

3-2.4.6.1 Preparation: Remove from reinforcing scale, heavy rust, and any coating which would reduce bond. Dowels shall not be coated with nonbonding agents.

3-2.4.6.2 Accessories: Provide spacers, chairs, wire ties, etc., necessary to properly assemble, space and support the reinforcing during placement of concrete, as recommended by the Concrete Reinforcing Steel Institute. Accessories shall be sized to provide required concrete coverage. Position and support bolts, anchors, and other cast-in items with appropriate accessories.

3-2.4.6.3 Slabs: Support reinforcing on sheet metal chairs spaced 4 feet apart.

3-2.4.6.3.1 Welded Wire Fabric: Roll out flat in longest practical lengths. Lap joints one mesh plus 2 inches, 6 inches minimum. Offset end laps of adjacent widths to prevent continuous lap. Fasten ends and sides of mesh at 48 inches o.c. with tie wire.

3-2.4.6.4 Anchor Bolts: If reinforcing conflicts with location of anchor bolts, inserts, etc., required to be cased in concrete, submit prompt notifications so that revisions can be made before concrete is placed. No cutting of reinforcing will be permitted without prior approval from the COR.

**3-2.5 QUALITY ASSURANCE:**

3-2.5.1 Mill Reports: Submit manufacturer's certified mill test sheets giving properties of steel used to fabricate reinforcing and location of mill.

3-2.5.2 Storage: Store reinforcing so that it is not less than 6 inches above ground.

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## **DIVISION 3-CONCRETE**

### **SECTION 3-3**

#### **CAST-IN-PLACE CONCRETE**

**3-3.1 GENERAL:** This section covers the minimum requirements for cast in place concrete.

**3-3.2 APPLICABLE DOCUMENTS:** The following specifications and standards of the issues currently in force form a part of this section and are applicable as specified herein.

**3-3.2.1 American Society for Testing and Materials (ASTM) Publications:**

C33	Concrete Aggregates
C94	Ready-Mixed Concrete
C150	Portland Cement
C260	Air-Entraining Admixtures for Concrete
C494	Chemical Admixtures for Concrete

**3-3.2.2 American Concrete Institute (ACI):**

305	Hot Weather Concreting
306	Cold Weather Concreting
309	Standard Practice for Consolidation of Concrete

**3-3.3 MATERIALS:**

**3-3.3.1 Cement:** ASTM C150, Type I Gray Portland Cement. The use of Type III cement permitted only with specific justification and approval. Submit brand name and mill reports for approval.

**3-3.3.2 Aggregate:** Conforming to ASTM C33. Fine - Natural sand. Coarse - crushed Limestone, 1-1/2 inch maximum.

**3-3.3.3 Water:** Potable.

**3-3.3.4 Chemical Admix:** ASTM C494 Type A or D (Type E may be used in cold weather upon written approval) polymer type compound (lignin compounds not acceptable) in liquid form, manufactured by one of the following firms:

Gifford-Hill and Co., Inc.  
W.R. Grace and Co.  
Master Builders  
Sika Chemical Corporation

Or other approved manufacturer.

Submit name of manufacturer or product proposed for use, as determined by weather conditions during time of concrete placement, as well as recommended Quantity. All other admixtures are not allowed.

3-3.3.5 Air Entraining Admix: ASTM C260 liquid vinsol resin compound compatible with chemical admix used.

Gifford-Hill and Co., Inc.  
Master Builders - MB-VR Protex Industries, Inc.  
Protex Air Entraining Solution  
Sika Chemical Corporation - Sika AER  
Or approved equal.

3-3.3.6 Control Joints: Submit for approval from the COR for method, tools and equipment proposed.

3-3.3.7 Plastic Barrier: Use a minimum 4 mil thick black polyethylene film sheeting, lapped 12 inches at edges and ends. Use under all localizer antenna pads. Repair if punctured.

### **3-3.4 INSTALLATION:**

3-3.4.1 Relation With Other Trades: Check other trades prior to placing concrete to ascertain that their work is in place. Where other work is required to be applied to concrete, provide satisfactory surface to receive it.

3-3.4.2 Cast-In Anchors and Accessories: Carefully place items required to be cast into concrete at location set by the trade which furnishes them. Templates shall be fabricated whenever feasible.

3-3.4.3 Strength Requirements: Unless noted otherwise on the plans, the minimum compressive strength of the concrete shall be 3000 psi in 28 days. Non-structural concrete to be used for the installation of ductbanks shall have a minimum compressive strength of 1,800 psi in 28 days.

3-3.4.4 Structural Concrete - Proportioning:

3-3.4.4.1 General: Conform to ACI 301 Standards. The mix design is intended to produce concrete which, when cured, will have a 28-day compressive strength equal to or greater than that required. If the strength required for the class of concrete being produced is not secured with the minimum cement content, additional cement shall be used or other aggregate provided at the Contractor's expense.

3-3.4.4.2 Proportioning of Ingredients: Determine mix proportions in conformance with Standards using Method 1 or 2.

3-3.4.4.3 Chemical Admix: Quantity, preparation and mixing shall conform to admix manufacturer's directions for use at temperatures anticipated when concrete will be placed. Admix may be used at the contractor's option. If used, adjust formulas for concrete mix to provide for it and obtain approval before concrete is ordered.

3-3.4.4.4 Air-Entraining Admix - If Required in Concrete: Conform to admixture manufacturer's directions for quantity, preparation and mixing. Concrete mix shall have between a 3% to 5% air-entrainment.

3-3.4.5 Mixing/Transit: Concrete may be porportioned and mixed on the job, dry-batched for mixing on the job, or procured from an approved "ready-mixed" concrete plant as follows:

3-3.4.5.1 Transit or ready-mixed concrete and delivery operations: Conform to ASTM C94. Do not add water at the job unless prior approval is given. Record the amount of any added water on each copy of the Delivery Ticket. If water is added, mix batch an additional 1 minute per yard of concrete, at slow speed, before placing it. Use no concrete which has been held in a mixer truck longer than 1-1/2 hours. At the truck, temperature of the concrete shall not exceed 90 degrees F.

3-3.4.5.2 Re-tempering: Concrete that is partially hardened shall not be retempered. A maximum of 5 gallons of water per 9 CY load may be initially added to adjust to the required slump. Once placement of the concrete has commenced, further addition of water shall be prohibited.

3-3.4.5.3 Dry-batched to the jobsite: Transport the dry materials in such a manner as to prevent loss, segregation, or contamination of the ingredients. Batch plant operations shall conform to Standards specified above.

#### 3-3.4.6 Structural Concrete - Placement Work:

##### 3-3.4.6.1 Preliminary work:

3-3.4.6.1.1 General: Verify that forms are clean and coated, and that reinforcing, pipes, conduit, sleeves, anchors, and other work required to be cast in concrete have been properly installed. Such work must be inspected and approved before placing is begun.

3-3.4.6.1.2 Concrete on Grade or Fill: Wet subsurface prior to placement of concrete. Note: Wetting of the subsurface is not required at the localizer antenna pad when the polyethylene sheeting is placed.

3-3.4.6.3 Excavated Areas: Excavation must be inspected and approved before concrete is placed. Do not place concrete on wet or soggy ground without first laying and compacting a bed of gravel of sufficient thickness to keep the mud from mixing with the concrete. Where water is present it must be kept below the level of the newly placed concrete continuously during placing and for at

least 24 hours thereafter. The excavated area must be so prepared that the water will easily drain to the pump without carrying any cement with it.

#### 3-3.4.7 Temperatures:

3-3.4.7.1 Cold Weather Concreting: Do not place concrete unless outside air temperature is at least 40 degrees F. and rising. For temperatures below 40 degrees F., special methods conforming to ACI 306 may be used upon approval from the COR.

3-3.4.7.2 Hot Weather Concreting: Placement of concrete during hot weather shall conform to the requirements of ACI-305. The concrete shall be protected from rapid drying by use of a water cure or curing compound. The COR reserves the right, based on temperature and humidity to determine when hot weather concreting conditions exist.

3-3.4.8 Method of Placement: Place concrete in the forms as rapidly as practical by methods that will prevent loss or separation of the ingredients. Deposit it as nearly as practicable in its final position in such a manner as to maintain a plastic surface which is approximately horizontal. If necessary to accomplish this, provide additional chutes or hoppers. Place concrete continuously, in layers not over 24 inches high at deep sections and not over 10 inches in height at shallow sections, in thinner layers if necessary so that fresh concrete will be placed against a layer that is still soft, except at approved joints. Vibrators shall not be used to push concrete laterally in the forms. Remove any wood spreaders as concrete rises in the forms.

3-3.4.8.1 Bond: Before depositing new concrete against set concrete, inspect forms and have them tightened if necessary. Thoroughly clean reinforcing and surface of set concrete to remove foreign matter. Saturate surface with water. Slush vertical or inclined surface of set concrete with grout coating composed of 1:1-1/2 cement:sand, and place new concrete before grout has attained its initial set.

3-3.4.9 Consolidation: Thoroughly consolidate concrete during and immediately after placement by means of mechanical vibrators. Demonstrate working condition of vibrator before concrete is ordered from the batch plant. Avoid over-vibrating concrete to an extent which might cause segregation of aggregate. Consolidation shall conform to ACI 309.

3-3.4.10 Concrete Finishing: Contractor shall begin finishing the concrete upon initial set of the concrete. Contractor shall limit the amount of water used on the concrete surface to facilitate finish work. The COR reserves the right to restrict the such use of water if determined to be detrimental to the final concrete surface. Concrete foundations and pads shall be broom finished. Concrete roadways shall be rake finished.

#### 3-3.4.11 Control Joints:

(a) Tooling:

1. General: Joints shall be true to line and profile and a minimum of 3/4" deep but no greater than 1". Tooling, if required, shall be performed while concrete is plastic. Joint may be started with a straight edge inserted into concrete.
  2. Jointing tool: Shall be 1/8" wide at surface, tapered, with top edges rounded to 1/8" radius.
- (b) Location: As shown on the drawings. Where not shown, provide joints not more than 16 ft. o.c. both ways.
- (c) Joint filler: Fill joints with preformed filler and cover with 1/4" deep mastic joint sealant.

3-3.4.12 Form Displacement: If forms become displaced in any way during placement of the concrete, the Contractor shall immediately stop the operation and do not resume placing until forms have been re-braced and brought back to required lines and levels.

3-3.4.13 Special Requirements:

3-3.4.13.1 Concrete Cover: Cover pipes, conduit, and reinforcing with not less than 1" of concrete unless specifically shown otherwise. Submit prompt notification of any location where there will be less coverage. Do not place pipes, conduit, or reinforcing at such locations until directed.

3-3.4.13.2 Equipment Pads: Provide concrete as required for pads or slabs, and bases or mounting supports as required for electrical equipment. Contractor shall furnish and locate all cast-in anchors required for equipment.

**3-3.5 QUALITY ASSURANCE:**

3-3.5.1 Submittals: Conform to procedures specified.

3-3.5.1.1 Concrete Source Submission: Prior to commencing operations, submit a statement indicating the mix proportions of the ingredients, maximum nominal coarse-aggregate size and slump of the mix that will be used. Proportions shall indicate weights of aggregates in saturated surface-dry condition. Accompany the statement with satisfactory evidence attesting that the proportions furnished will produce concrete of the quality indicated.

3-3.5.1.2 Concrete Tickets: The Contractor shall request a concrete ticket for each batch delivered to the site. The ticket shall indicate the design strength of the mix and the batching time. The concrete supplier shall certify that each load meets the minimum requirements indicated within this specification. The ticket and the certification shall be forwarded to the COR at the time of delivery.

3-3.5.1.3 Control Joint Submittal: The Contractor shall submit for approval from the FAA for the method, tools and equipment proposed to install control joints for the localizer concrete pads.

3-3.5.2 Testing: The Government will retain a testing laboratory to perform the testing of concrete cylinders. The costs of tests shall be borne by the Government. Any retesting required because of failure of concrete to meet specification requirement shall be paid for by the Contractor. The cylinders will represent the batch of concrete from which they were taken. Three (3) test cylinders will be made for each strength test. Specimens will be tested at 7 and 28 days with one held in reserve in case improper sampling, molding, or testing requires an additional test. Test specimens will be tested in accordance with ASTM C-39. Concrete that does not meet the requirements shall be removed and replaced at the expense of the Contractor. Slump tests will be performed by the Resident Engineer. The slump cone and rod shall be furnished by the Contractor. Forming, curing, and testing of concrete cylinders will be done at the Government's expense. The concrete slump tests will be taken and tested in accordance with ASTM C-172 and ASTM C-143.

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## **DIVISION 3-CONCRETE**

### **SECTION 3-4**

#### **FINISHING AND CURING**

**3-4.1 GENERAL:** This section covers finishing and curing of the cast-in-place concrete.

**3-4.2 APPLICABLE DOCUMENTS:** The following specifications and standards of the issues currently in force form a part of this section, and are applicable as specified herein.

**3-4.2.1 Federal Specifications:**

UU-B-790	Building Paper, Vegetable Fiber: (Kraft, Waterproofed, Water Repellent and Fire Resistant)
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**3-4.2.2 American Society for Testing and Materials (ASTM) Publications:**

C171	Sheet Materials for Curing Concrete
C309	Liquid Membrane-Forming Compounds For Curing Concrete
C881	Epoxy-Resin-Base Bonding Systems for Concrete
C494	Chemical Admixtures for Concrete

**3-4.2.3 American Concrete Institute (ACI):**

301	Specifications for Structural Concrete for Buildings
302	Recommended Practice for Concrete Floor and Slab Construction
305	Hot Weather Concreting
306	Cold Weather Concreting

**3-4.2.4 U.S. Department of Commerce Commercial Standards (CS):**

CS238	Polyethylene Sheet
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**3-4.3 MATERIALS:**

**3-4.3.1 Waterproof Paper:** ASTM C171, Type I or Federal Specification UU-B-790 Reinforced Kraft Paper.

Glas-Kraft, Inc. - Glas-Kraft Grade A  
St. Regis Paper Co. - Sisalkraft Sk-10

Or approved equal.

3-4.3.2 Plastic Sheet: U.S. Commercial Standard C5238 polyethylene sheet in 4 mil minimum thickness.

3-4.3.3 Curing Compounds: ASTM C309, Type 1 compounds.

3-4.3.4 Insulating Blanket: Polystyrene foam sheets, foamed vinyl blankets or mineral wool fibers encased in polyethylene liner.

### **3-4.4 INSTALLATION:**

3-4.4.1 Relation With Other Trades: Level slab surfaces which are unsuitable for the work of other trades.

3-4.4.2 Tolerance - Horizontal Surfaces: Conform to ACI 30I Chapter 11 and ACI 302, unless modified. Edges of areas shall be level and true to line against forms. Screed surface using straightedges and wet screeds.

#### 3-4.4.3 Finishes:

3-4.4.3.1 Standards: Conform to ACI 301 Chapter 11 unless modified or exceeded by the requirements of this Specification.

3-4.4.3.2 Exterior Concrete: Trowel and medium broom finish with joints finished with edging tool. The perimeter of all concrete structures shall have a chamfer edge. Broom after concrete is hard enough to retain a scoring.

3-4.4.3.3 Roadway Finish: NOT USED

3-4.4.4 Repair of Defects: Concrete surfaces that are visible shall be free of defects and shall be smooth. Immediately after removal of forms, cut off metal ties, chip out adjacent surface to permit proper patching, cut out honeycomb areas, and remove fins. At holes and cracks, point areas flush using epoxy bonding agents and epoxy mortar, ASTM C881, Type III C, gray. Install and cure in accordance with manufacturer's directions.

#### 3-4.4.5 Curing:

3-4.4.5.1 General Requirements: Protect concrete from loss of moisture, rapid drying or temperature changes, injurious action by the sun, rain, flowing water, or frost, and mechanical injury, at a temperature not less than 50 degrees F., from the time of placing until the end of the time of curing. Keep wood forms, left in place during curing, damp at all times to prevent opening at the joints and drying of concrete. No period during which moisture or warmth is lacking shall be counted effective for curing.

## **DIVISION 16- ELECTRICAL**

### **SECTION 16-1**

#### **UNDERGROUND POWER & COAXIAL CABLE INSTALLATION**

##### **PART 1 GENERAL**

###### **1.1 Description of the Work:**

Install Heliac cables (GFM) from new junction box outside AFSS to each tower. Furnish all labor and materials for the installation of channel, beam clamps, and cable clamps on the towers to hold the heliac cable firmly in place, as indicated on the drawings. Furnish all labor and materials for the installation of the Heliac cable connectors and the Liquid Tight strain reliefs in the junction boxes.

###### **1.2 Specific Items of Work:**

- A. Install 16 total runs of new (GFM) 7/8" Heliac cables from new tower junction box to the AFSS building.
- B. Secure new Heliac cable in accordance with Part 3 of this section, and the project drawings.
- C. Perform cable testing in accordance with Section 3.4 of this specification.

###### **1.3 References:**

- A. NFPA 70 - National Electrical Code.

##### **PART 2 MATERIALS**

###### **2.1 Heliac Cable (GFM) – 7/8" diameter Heliac cable (GFM).**

###### **2.2 Tower cable clamps – galvanized steel with rubber insulated cable clamp intended for outdoor use. Use Andrew L4Click or Snap-Stak cable clamp or equal. Size shall fit the heliac cable snug.**

###### **2.3 Anchor rail adaptor – attaches to Unistrut and accommodates Snap-Stak clamps. Use Andrew ARA-22 or equivalent.**

###### **2.4 Tower brace beam clamps – used to attach Unistrut channel to tower members. Thomas & Betts 500SC or equivalent.**

- 2.5 Support systems – All steel and hardware shall be hot dipped galvanized. Channel shall be 12 gauge, 1 5/8 inch X 1 5/8 inch hot dipped galvanized steel. Use Unistrut P1000 or equal.

### **PART 3 EXECUTION**

- 3.1 Tower cable support system – Install support system on tower in accordance with the project drawings and applicable manufacturer's instructions.

3.2 Installation:

- A. The Contractor shall take all precautions not to damage the (GFM) cable. If the contractor damages or kinks the cable before, during or after installation, he/she shall replace the cable at his/her own expense. Refer to section 3.5 for cable testing requirements.
- B. No splices shall be permitted in cable runs. They shall be continuous.
- C. No bends shall be made during installation of less than 18 inch radius.
- D. If a cable is kinked, it shall not be installed.
- E. Pull cable in such a way as to prevent harmful stretching of the conductor, injury to the insulation or damage to the outer protective covering.
- F. All cable ends shall be sealed with moisture-sealing tape before pulling, and shall be left sealed until connections are made.
- G. Cable may be pulled by hand or by using a winch. Contractor shall use a pulling tube with sheaves at least 35 times the diameter of the cable at all handholes.
- H. The surface of the cable sheath or jacket may not be damaged to a depth of more than 1/10 of the thickness of the sheath nor flattened out of round by more than 1/10 of the outside diameter.

3.3 Securing cable:

- A. Helix cable shall be secured to horizontal sections of Unistrut that are clamped to flanges of the existing tower horizontal members.
- B. Vertical spacing of cable attach points on tower face shall not exceed 36".

- C. Cable shall be attached securely to Unistrut using Andrew L4Click, or Snap-Stak connectors, or equivalent.
- D. Cable shall be routed into new tower junction boxes through holes drilled in bottom of box, and secured to box with strain relief cable connectors.

#### 3.4 Cable Tagging:

- A. All cables shall be tagged in each Jbox, manhole and pull box with not less than two tags per cable, one near each duct entrance hole. Tags shall be attached to cable immediately after cable installation. Cable shall be tagged as to function, i.e., facility which it serves or other pertinent information. Tags shall be circular in shape, 2-inch minimum diameter and of not less than 0.020 inch thick copper or 0.0625 inch thick lead. Steel lettering dies, 1/4 inch minimum size or the equivalent engraving process, shall be used to mark the tags. Each tag shall be securely attached to the cable using 1/8-inch nylon cord. Tags shall be marked with an abbreviation of the name of the facility or facilities served by the cable plus an appropriate letter: "P", "T", "C", or "R".

#### 3.5 Inspection & cable testing by the Contractor:

- A. Perform all inspection and cable test in the presence of the COTR.
- B. The contractor shall test all cables (power and Co-axial) as indicated in FAA-C-1391b, 4.6. The contractor shall test all cables before it is pulled into the duct system and repeat the same test after installation.
- C. During the initial cable test (before installation), if any cable fails to meet test requirements the contractor shall not install it. If the cable is contractor furnished, it shall be replaced at no cost to the government. If the cable is government furnished, the defective cable will be replaced by the government.
- D. After the cable installation (pulled into the duct); the contractor shall repeat the cable test to ensure they have not been damaged during the installation process. If any cable fails to meet test requirements, the contractor shall replace that cable at no cost to the government, including the government furnished cable.

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## **DIVISION 16-ELECTRICAL**

### **SECTION 16-2**

#### **BONDING, GROUNDING, AND LIGHTNING PROTECTION**

- 1.1 **General:** The contractor shall provide all labor, equipment and materials as necessary to install lightning protection and grounding systems as specified on the drawings and in this specification. The contractor's work shall comply with all applicable sections of FAA-STD-019e, Lightning Protection, Grounding, Bonding and Shielding Requirements for Facilities. The major work items for this project are as follows:
1. Grounding of metal boxes, conduits and other metal objects.
  2. Grounding of bulkhead plate.
  3. Installation of air terminals and associated down conductor on antenna tower access platforms.
- 1.2 **Applicable Documents:** The following specifications and standards of the issues currently In force, form a part of this section, and are applicable as specified herein.
- 1.2.1 National Fire Protection Association (NFPA) Publications-
- No. 70 National Electric Code  
No. 780 Standard for the Installation of Lightning Protection Systems
- 1.2.2 Underwriters' Laboratories
- UL 96A Installation requirements for Lightning Protection Systems
- 1.2.3 Federal Aviation Administration
- FAA STD 019e Lightning Protection, Grounding, Bonding and Shielding Requirements for Facilities
- FAA-C-1217f Electrical Work, Interior
- 1.3 Submittals:**
- 1.3.1 Grounding Conductors – product data sheet.
- 1.3.1 Bonding Jumpers – product data sheet.
- 1.3.2 Hardware – product data sheets.

### 1.3.3 Air Terminal Assembly – shop drawing.

## **PART 2 MATERIALS**

- 2.0 Materials: All materials shall be new, the standards products of manufacturer's regularly engaged in the production of such materials, and of the manufacturer's latest designs that comply with those shown on the drawings and as specified herein.
- 2.1 Air Terminal and Down conductor: Air terminals shall be nickel tipped 5/8" x 24" solid copper with a rounded or "bullet" point and cat bronze vertical point fitting. The down conductor shall be a No. 28R stranded, Class 2 copper conductor. It shall consists of 28 strands of 14 gauge copper wire, 1/2 " diameter, 115,000 circular mils, net weight 375 lb per 1000ft or equal.
- 2.2 Grounding Conductors: The grounding electrode conductor shall have green colored insulation or be bare copper and sized as shown on the contract drawings. Where not shown, the conductor shall be sized in accordance with the National Electric Code except that it shall not be sized smaller than No. 6 AWG for bare conductors. The grounding conductor for the bulkhead plates shall be a 4/0 AWG insulated copper cable with green jacket and red tracer.
- 2.3 Bonding Jumpers: Bonding jumpers used in interior locations to bond sections of metal objects shall be insulated copper and sized in accordance with Table 250.133 of the NEC but not less than 6 SWG.
- 2.4 Other Hardware: Fasteners shall be of the same materials as the conductor base material or copper in most cases. Fasteners shall not be made of aluminum, galvanized steel or plated materials. Bonding devices, cable splicers and connectors shall be suitable for use with the installed conductor and be copper or bronze with bolt pressure connections.
- 2.5 Ground Rods: Ground rods shall be copper or copper clad steel, a minimum of 10 ft. (3 m) in length and 3/4 in. (19 mm) in diameter. Rod cladding shall not be less than 1/64 in. (19 mm) thick.

## **PART 3 EXECUTION**

- 3.0 Installation: The location of the grounding system for the facility shall be as indicated on the contract drawings, as specified in FAA STD 19e, as required by the applicable documents and as specified herein. In the event of conflicting requirements, the most stringent shall apply.

- 3.1 Air Terminal Assembly: Install assembly and air terminal as shown on the drawings. Top of air terminal shall be as shown on the drawings. Anchor antenna down conductor to mast every 3 feet with U-bolt pipe clamps, Thompson No. 803, or equal.
- 3.2 Metal Conduits: Conduits shall be terminated with an insulated, grounding bushing at all junction boxes, handholes and building entries. Conduits in enclosures shall be interconnected with a single, grounding conductor. At junction boxes, conduits shall be grounded to the existing buried counterpoise. At handholes, the conduits shall be grounded to a ground rod.
- 3.3 Tower Junction Box Bulkhead Plates: A green-jacketed with red tracer #4/0 copper conductor is to be installed from the junction box to the tower EES. The conductor is to be clamped along the exterior face of the tower at maximum 36" vertical spacing. The conductor must be exothermically welded to a grounding rod as indicated on the drawings.
- 3.4 Building Junction Box Bulkhead Plate: A green-jacketed 4/0 copper conductor is to be installed between the building junction box bulkhead plate and the building EES, via new PVC conduit extending from the base of the junction box into the ground. The conductor shall be exothermically welded to the existing EES.
- 3.5 Metal Bodies: Metal bodies (downspouts, gutters, vents, ladders, etc.) within 6 feet of an exposed lightning protection system shall be bonded to the lightning protection system with Class 2 secondary conductors and approved UL fittings and splicers.
- 3.6 Duct banks: The contractor shall install #1/0 AWG bare copper conductor a minimum of 10 inches above the cables and exothermically weld it to the earth electrode system or a round rod.
- 3.7 Ground Rods: Ground rods shall be as widely spaced as practical, and in no case spaced less than one rod length. Nominal spacing between rods should be between two and three times rod length. Tops of ground rods shall be not less than 1 ft. (0.3 m) below grade level. Ground rods shall be located 2 to 6 ft. (0.6 to 1.8 m) outside the foundation or exterior footing of the structure.
- 3.8 Connection onto Ground Rods: All bare copper wires connected to a ground rod as specified on the project drawings shall be an exothermic weld.
- 3.9 Grounding Connections: All equipment, armored cable, GRS conduit and all other exposed, non-current carrying metal parts of electrical equipment shall be grounded by an equipment grounding conductor sized as designated in the drawings and specifications, but in no case smaller than that required by Table 250-95 of the NEC. Bare conductors shall not be permitted except for where shown on the drawings. All connections to the equipment to be grounded shall be made with a ground connector specifically intended for that purpose. Connecting screws or mounting bolts are not suitable for use as grounding connections.

Connections to ground electrodes and all other underground connections shall be exothermic welded except at access wells.

- 3.10 Exothermic welds: Exothermic welds may be used for any type of bond connection specified herein. Exothermic welds shall be used for all underground connections between earth electrodes, counterpoise cable and other connections to the earth electrode system.
- 3.11 Other Hardware: Install hardware in a neat manner, parallel or perpendicular or plumb where fastened to surfaces. Prior to bonding to surfaces, all connection points shall be cleaned of paint, insulation and other non-conducting materials over an area that extends at least ¼ inch beyond the bonding surface of the larger member.
- 3.12 Underground Connections: No part of the underground cable or connections shall be concealed until the Contracting Officer's Representative has inspected, tested and approved the ground rods or plates, conductors and connections in that part of the system. Any faulty connections or items shall be corrected or replaced as directed by the Contracting Officer's Representative.
- 3.13 Grounding Electrode Test: Contractor shall measure the earth electrode grounding resistance of the installed counterpoise. Test shall be the 3-point fall-of-potential measurement of the earth electrode system resistance and in accordance with FAA Specification 1217f, 5.3.6. The contractor shall record the test results and submit the report to the Contracting Officer's representative. The contractor shall notify the Contracting Officer's representative immediately if the resistance of any test is above 10 ohms.

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## **DIVISION 16-ELECTRICAL**

### **SECTION 16-3 ELECTRICAL WORK**

**16-3.1 General:** This section covers the minimum requirements for interior electrical work. The installation shall conform to local and national rules and regulations and the National Electrical Code.

**16-3.2 Applicable Documents:** The following specifications and standards of the issues currently in force, form a part of this section and are applicable as specified herein.

#### **16-3.2.1 Federal Specifications:**

J-C-30	Cable and Wire, Electrical (Power, Fixed Installation)
W-C-375	Circuit Breakers, Molded Case; Branch Circuit and Service
W-C-586	Conduit Outlet Boxes, Bodies and Entrance Caps Electrical: Cast Metal - For Shore Use
W-C-1094	Conduit and Conduit Fittings; Plastic, Rigid
W-J-800	Junction Box; Extension, Junction Box: Cover, Junction Box (Steel, Cadmium or Zinc - Coated)
W-P-II5	Panel, Power Distribution
W-S-610	Splice, Conductor
W-S-865	Switch, Box (Enclosed), Surface - Mounted
WW-C-563	Conduit, Metal, Rigid: Electrical, Thin-Wall Steel Type (Electrical Metallic Tubing); Straight Lengths, Elbows and Bends
WW-C-566	Conduit, Metal, Flexible
WW-C-581	Conduit, Metal, Rigid; and Coupling, Elbow, and Nipple, Electrical Conduit: Zinc Coated

#### **16-3.2.3 National Fire Protection Association (NFPA) Publications:**

No. 70	National Electrical Code (N.E.C.)
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#### **16-3.2.4 National Electrical Manufacturers Association (NEMA) Standards:**

WC 5	Thermoplastic Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
WD 1	General Purpose Wiring Devices

#### **16-3.2.5 Underwriters' Laboratories, Inc:**

UL 870	Wireways, Auxiliary Gutters and Associated Fittings
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**16-3.2.6 Local Utility Companies:** The rules and regulations of the local utility companies providing service.

16-3.2.7 Local Governing Bodies: The rules, regulations and codes of the local city, county and state.

16-3.2.8 Reference Documents: The information contained in this specification section was adapted from FAA Order 6950.1 and FAA Standard FAA-C-1217E

### **16-3.3 Installation:**

16-3.3.1 Materials: The Contractor shall furnish all materials not specifically shown on the Government Furnished Property List. Materials and equipment must comply with all contract requirements. Materials to be furnished by the Contractor under this specification shall be new, the standard products of manufacturer's latest designs that comply with the specification requirements. All materials for installation in hazardous or wet locations shall be listed and labeled by the Underwriters Laboratory (UL) as suitable for hazardous or wet locations. All other materials provided by the Contractor shall bear the label of UL if the materials are normally evaluated and labeled by UL.

16-3.3.2 General: The rules, regulations and reference specifications referenced herein shall be considered as minimum requirements and shall not relieve the Contractor from furnishing and installing higher grades of materials and workmanship than are specified herein or on the contract drawings. This specification shall govern when conflicts occur between reference documents and this specification.

16-3.3.3 Workmanship: All materials and equipment shall be installed in accordance with the contract drawings and the recommendations of the manufacturer as approved by the Resident Engineer. The installation shall be accomplished by skilled workmen regularly engaged in this type of work. Where required by local regulations, the workmen shall be properly licensed.

16-3.3.4 Contract Drawings: Where the electrical drawings indicate (diagrammatically or otherwise) the work intended and the functions to be performed, even though some minor details are not shown, the Contractor shall furnish all equipment, material (other than Government Furnished Items), and labor to complete the installation work and accomplish all the indicated functions of the electrical installation.

16-3.3.5 Minor Departures: Minor departures from dimensions shown in electrical plans may be permitted where required to avoid conflict or unnecessary difficulty in placement of a dimensioned item, provided all contract requirements are met. The Contractor shall promptly obtain approval from the Resident Engineer prior to undertaking any such proposed departure.

16-3.3.6 Interior Grounding: The grounding system for the facility shall be as indicated on the contract drawings and as specified herein. The National Electric Code, except where otherwise indicated hereinafter, shall govern, but in no case shall the Code be violated. See section 16-2 for requirements of the individual grounding systems.

### **16-3.4 Wiring Methods:**

**16-3.4.1 General:** Unless otherwise indicated, wiring shall consist of insulated copper conductors installed in heavy-wall zinc coated rigid steel conduit or electrical metallic tubing. For single-phase systems (120 volt, two wire and 120/240 volt, 3 wire), one grounded conductor (neutral) shall accompany each ungrounded phase conductor or ungrounded phase conductor pair powered from a circuit interrupting device. All neutral conductors shall extend from the neutral bus in the device where the active conductors originate.

- a. **Raceway System:** Minimum conduit or tubing size shall be 3/4 inch. Each run shall be complete, and shall be fished and swabbed before conductors are installed. Ends of conduit systems not terminated in boxes or cabinets shall be capped. Exposed raceways shall be installed parallel to or at right angles with the lines of the structure unless otherwise indicated on the drawings.

Where conduit has to be cut in the field, it shall be cut square using a hand or power hacksaw or approved pipe cutter using cutting knives. The cut ends of the field-cut conduit shall be reamed to remove burrs and sharp edges. Where threads have to be cut on conduit, the threads shall have the same effective length and shall have the same thread dimensions and taper as specified for factory cut threads on conduit. Conduits installed with threads not complying with these requirements shall be removed and replaced with conduits which comply. Clean threads of all oil and shavings and apply a cold zinc rich paint to damaged galvanizing.

- b. **Heavywall Zinc Coated Rigid Steel Conduit:** Heavywall zinc coated rigid steel conduit shall conform to Federal Specification WW-C-581. Rigid steel conduit may be used in all locations. All fittings for use with rigid steel conduit shall be of the threaded type of the same material as the conduit. Where conduits enter boxes or cabinets without threaded hubs, double locknuts shall be used plus a phenolic insulated metallic grounding bushing on the open end.
- c. **Electrical Metallic Tubing (EMT):** EMT shall conform to Federal Specification WW-C-563. EMT may be used only in dry interior locations, and where not subject to physical damage. EMT shall not be used as nipples for wall penetrations between j-boxes or other type of enclosures. EMT shall not be used on circuits rated above 600 volts. Fittings to be used with EMT shall be standard compression fittings designed for use with this type of conduit. Screw-type fittings are not acceptable. Where conduits enter enclosures without threaded hubs, an appropriate connector with threads and locknut shall be used to securely bond the conduit to the enclosure. The connector body and locknut shall be installed so that firm contact is made on each side of the enclosure. In addition, the connectors shall be the insulated-throat type.
- d. **Rigid Plastic Conduit:** Rigid plastic conduit shall be heavywall PVC conforming to Federal Specification W-C-1094, Type II. Rigid plastic conduit used to protect electrical power conductors may only be used underground, or in concrete, or as a vertical riser to 6 inches

above grade or floor surface for connection to metal conduit or enclosure; and only when required by the contract drawings. PVC fittings shall be used with PVC conduit and shall be assembled in accordance with manufacturer's instructions. A PVC threaded fitting with locknut and plastic bushing shall be used to connect PVC conduit to boxes or cabinets without threaded hubs. Rigid plastic conduit may be used to protect lightning protection system conductors and, in interior locations, to protect signal grounding conductors.

- e. Flexible Steel Conduit: Flexible steel conduit shall conform to Federal Specification WW-C-566. Flexible steel conduit may be used only where shown in the project drawings or where approved by the Resident Engineer. Liquid-tight flexible conduit shall be used outdoors and in wet locations. A separate equipment grounding conductor shall be provided across all flexible conduit connections.
- f. Boxes: Boxes shall be either cast metal hub type conforming to Federal Specification W-C-586 or shall be one piece galvanized steel type conforming to Federal Specification W-J-800. Where not sized on the drawings, boxes shall be sized in accordance with the NEC. Boxes shall be provided in the wiring or raceway system for pulling wires, making connections and mounting devices or fixtures. Boxes for metallic raceways shall be of the cast metal threaded hub type in wet locations and surface mounted exterior applications.

#### 16-3.4.2 Conductors:

- a. Un-insulated Conductors: Un-insulated conductors shall be copper in accordance with Federal Specification QQ-W-343.
- b. Insulated Conductors: Insulated conductors shall be copper with thermoplastic or thermosetting insulation, type THW, THWN, and XHHW for general use, all insulated for 600 volts in accordance with Federal Specification J-C-30 and ICEA 5-61-402. Conductors #10 AWG and smaller shall be solid, and conductors #8 AWG and larger shall be stranded. Minimum branch circuit conductor size shall be #12 AWG.
- c. Color Coding: All branch circuits and feeder conductors shall be color coded as specified hereinafter. The color coding shall be continuous throughout the facility on each phase conductor to its point of utilization so that the conductor phase connection is readily identifiable in any part of the installation. Conductors #10 AWG and smaller shall have color coded insulation, conductors larger than #10 AWG may be color coded using half-lapped tape for a minimum length of 3 inches.

White conductors may only be used for neutral and green may only be used for equipment grounding conductors. Where conductors are color coded in this manner, they shall be color coded in all junction and pull boxes, accessible raceways, panelboards, outlets and switches, as well as at all terminators. Conductors in accessible raceways shall be coded in such a manner that by removing any cover, the coding will be visible. Phase conductors shall be color coded as follows:

Three Phase 120/240 Volt

Line 1 - Black

Line 2 - Red

Color coding for conductors in control cables shall be in accordance with NEMA Standard WC-5.

16-3.4.3 Wiring Devices:

- a. Receptacles. - Receptacles shall be of the voltage and current rating indicated on the drawings. All receptacles shall be specification grade in accordance with NEMA STD WD-1. Wiring terminals shall be of the screw-type. Receptacles with push-in connections or a combination of screw-type and push-in connectors are not acceptable. Unless noted otherwise, receptacles shall be installed 12 inches above finished floor. All receptacles, unless they are of the isolated-ground type, shall be grounded by the installation of open cracks. Fittings, elbows, clips, mounting straps, connection blocks, and insulators, shall be provided as required for a complete installation.
- b. Duplex Receptacles: Unless otherwise indicated, general purpose duplex receptacles shall be specification grade, 15 ampere minimum rating, 125 volt, grounding type (NEMA 5-15R per NEMA Standard WD-1).
- c. GFI Receptacles: Ground fault interrupting receptacles shall be installed for general purpose 120V usage at locations as indicated on the drawings. GFI receptacles shall be 15 amp, 120V, duplex, UL Group I, Class A. All exterior GFI receptacles shall be mounted in a weather box with weatherproof cover.

16-3.4.4 Panelboards: Panelboards shall conform to Federal Specification W-P-115, Type I, Class I, and shall be listed by UL. All panelboards shall have a piano hinged door-in-door cover. All door hinges shall be concealed. Door shall have a flush type cylinder lock and catch. Doors over 48 inches in height shall have auxiliary fasteners on top and bottom. Directories shall be typed to indicate the load served by each circuit and shall be mounted in a holder with protective covering. The directory shall be arranged so that the typed entries simulate the circuit breaker positions in the panelboard. Panelboards shall be mounted so that the height to the top of the panelboard shall not exceed 72 inches above finished floor or as shown in the project drawings.

- a. Circuit Breakers: All circuit breakers shall be the quick-make, quick-break bolt on, thermal magnetic type, and shall conform to Federal Specification W-C-375 and be UL listed. Circuit breakers shall be rated for the voltage of the circuit on which they are used and shall have a minimum interrupting rating of 22,000 amperes fully rated, symmetrical for branch breakers and main breakers. All circuit breakers shall have a trip indicating feature. Single pole breakers shall be a full size module, and two and three pole breakers shall be sized in even multiples of a single pole breaker. Breakers shall be sized so that two single pole breakers shall not be capable of fitting in a single housing. Multi-pole circuit breakers shall

have an internal common trip mechanism. All circuit breakers and panelboards in which the breakers are installed, shall be made by the same manufacturer.

- b. Bus Bars: Buses shall be copper. Bus capacity shall be a minimum of 100 amps except where used at the Inner Marker site. Bus capacity for the panel used at the Inner Marker shall be equal to or greater than the panelboard feeder overcurrent protection device. Circuit breaker current-carrying connections to bus shall be of the bolted type, factory assembled. Stab-in types are not acceptable. Bus bar connection to branch circuit breakers shall be of the sequence phase type. The branch circuits shall be connected to the individual circuit breakers as indicated on the drawings. Where branch circuits have been disconnected from an existing panel which was removed, those circuits shall be reconnected to the new circuit breakers in the new power panel as shown in the project drawings.

The neutral bus shall be insulated from all panelboards except where the main panelboard is used as a service disconnect means. All panelboards shall have an un-insulated ground bus bolted to the cabinet, adequate in size to accommodate all present and future equipment grounding conductors. The ground bus shall be isolated from the neutral bus except at the service disconnect means. Where "provisions for", "future:", or "space" is noted on the drawings, the panelboard shall be equipped with bus connections for future installation of a breaker.

- c. Identification: Identified with a name plate which shows the functional name of the unit, voltage utilized, one or three phase as applicable, and any other pertinent information. Name plates shall be non-ferrous metal or rigid plastic, stamped, embossed or engraved with 3/16 inch minimum height lettering or numerals. The plates shall be secured to the equipment with a minimum of two screws.

### **16-3.5 Quality Assurance Provisions:**

16-3.5.1 Material Certified Acceptance: All equipment and materials covered by referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification. Refer to section 1.4.3. Material submittals for items specified in this section shall be submitted to the COTR for review.

16-3.5.2 Testing: The Contractor shall furnish the instruments, materials and labor necessary to perform the following tests. All tests shall be performed in the presence of the Resident Engineer. The Contractor shall submit a written test report to the Resident Engineer when the tests are complete.

- a. Insulation Resistance Test: Branch circuits shall have their insulation tested after installation, but before connection to terminals. All conductors shall test free from short circuits and grounds, and a minimum insulation resistance phase-to-phase and phase-to-ground shall be 50 mega-ohms measured with a 500 volt insulation resistance tester.

- b. Neutral Isolation Test: After installation of all branch circuits, the neutral in the service entrance switch shall be tested for isolation from ground with an ohmmeter set on its RXI scale. The incoming neutral shall be temporarily disconnected to accomplish this test. Any contact between the neutral and ground (other than the entrance switch) is a possible cause of noise and shall be corrected.
- c. Cables: All cables shall be tested in accordance with FAA order 6950.22 prior to installation and again upon completion of the installation. All testing shall be accomplished before connection is made to any existing equipment.
- d. Operating Test: After the interior wiring system installation is completed, and at such time as the contracting officer may direct, the contractor shall conduct an operating test for approval. The equipment shall be demonstrated to operate in accordance with the requirements of this specification. The test shall be performed in the presence of the FAA Resident Engineer.

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